



1 NOVEMBER 2002

Personnel

INFORMATION FOR DESIGNERS OF INSTRUCTIONAL SYSTEMS

APPLICATION TO AIRCREW TRAINING

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OPR: HQ AETC/DOZ (Gary J. Twogood)
Supersedes: AFH 36-2235, Volume 8, 1 November 1993

Certified by: HQ USAF/DPDT
(Col Patricia L. C. Priest)
Pages: 253/Distribution: F

This volume provides information and guidance for applying the Instructional System Development process described in AFMAN 36-2234. This handbook is a guide for Air Force personnel who plan, design, develop, approve, administer, or manage aircrew training in the Air Force. It is designed to be used as you need it in aircrew training. Although several references are listed, this handbook is intended to be used alone without any requirement to read other ISD handbooks. Each handbook is developed for a particular community and has the appropriate language and applications to support it. You are not required to read this handbook from cover to cover but may enter it at any desired phase of instruction where information is available to resolve your problem. You may use this handbook to design or revise a curriculum, a course, or any isolated aspect of it.

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Chapter 1

GENERAL INFORMATION

Overview

Introduction

Training from the back seat of an aircraft with a new student is often a harrowing experience. Questions such as "When do I take over control of the aircraft? Does the student know what he or she is doing? What am I doing here?" are not new. All instructor pilots have these feelings at one time or another. To ensure that the ground training and flying training support each other requires a systematic approach that standardizes each training program. No one in the training business wants to lose an aircraft or crewmember, or be unable to defeat the enemy. Therefore, to assist you with this very important mission, this handbook serves as a guide for applying Instructional System Development (ISD) to the design, implementation, administration, and management of aircrew training in the Air Force. It adheres to the policies of AFD 36-22 and follows the principles and procedures of AFMAN 36-2234. The guide is intended to be easy reading for novice and experienced managers, curriculum developers, and instructors. While it is designed as a "stand-alone" document, reading and being familiar with AFD 36-22 and AFMAN 36-2234 will make developing training easier. As the need arises for more information on specific areas of training development, it is recommended that you read the other sources of information referenced throughout this handbook.

Background

In the past, the Air Force ISD manual and handbook were focused on applying ISD to technical training. There was little, if any, guidance on how to apply ISD in the other training communities such as aircrew and acquisition. The revised AFMAN 36-2234 provides the necessary principles, procedures, and guidance for applying ISD throughout the Air Force, with the various volumes of AFH 36-2235 providing more detailed and specific information for applying ISD in the various communities. Also, other volumes of AFH 36-2235 have been developed to cover such areas as selecting the appropriate computer-based training, applying ISD to unit-level training, and a look at the latest training technologies available to the aircrew trainer.

Purpose

This handbook provides specific information and guidance for using the ISD process to develop aircrew training. It provides information on the ISD model, planning ISD projects, phases of development, system functions, and quality improvements.

Is this handbook for you?

This handbook addresses the question: "How do you apply ISD to aircrew training?" It is applicable to both Air Force and contractor-developed training. But is it for you?

Are You Responsible For . . .	Yes	No
Developing training for any task associated with flying aircraft?		
Managing contractors during training development?		
Are You . . .	Yes	No
An aircrew member responsible for developing and delivering a training course?		
A training specialist using ISD to develop aircrew training?		
A "novice" curriculum developer?		

If you checked **YES** to any of these questions, this handbook will help you do your job.

What is ISD?

ISD is a systematic, but flexible, process used to plan, design, develop, and deliver an effective and efficient training system. It is a **total quality process**, which continuously strives to improve the system. ISD ensures that:

- There is a training need.
- There is a solution to the need.
- The solution can be implemented.
- The solution can be assessed to determine whether it meets the need.
- Quality improvements are made throughout the ISD process.

Basis for ISD

ISD is based on:

- Basic research as to how people learn
- Basic research as to how people communicate
- The systems engineering process
- The concepts of instructional technology

Why use ISD?

Using ISD helps ensure that training is both effective and efficient. ISD requires that you:

- Design training to meet specific job requirements that have been identified through a training needs assessment.
- Design training for all job elements that are critical to successful performance.
- Design training to meet specific training objectives.
- Choose methods and media to optimize cost-effectiveness and efficiency of training.
- Evaluate training to make sure the objectives are being met.
- Collect and use student data to improve training quality.

Goals of ISD

The goals of ISD are to:

- Produce graduates who meet job performance requirements.
- Produce a cost-effective, efficient training system.
- Continually improve training quality.

How to use ISD

ISD is:

- Flexible and systematic
- A tool to get the right training to solve the problem
- Not a lock-step, linear process

ISD is a cyclic process that begins with the analysis phase, during development of the instructional system, and continues through the implementation phase. Evaluation is an active, integral part of each phase of the process and the source of

How to use ISD (Continued)

continuous feedback and improvements for the life cycle of the system. During initial system development, instructional system developers may reenter phases of the process, as necessary, to ensure effectiveness and cost-efficiency of the system. During updates or revisions to a mature system, the developer enters the phase of the process as determined by the nature and scope of the update and reenters phases of the process if necessary.

How to use this handbook

This handbook will help you develop aircrew training courses.

Think about your specific assignment and use the information in this handbook to design, develop, and implement an effective and efficient training system. Start by using the following questionnaire to read about sections that affect you.

Do You Have To . . .	Yes	No	Page
Determine personnel needs of the system?			48
Determine Training Needed to Meet Requirements?			51
Determine training system requirements?			53
Develop an ISD evaluation plan?			55
Write a training development plan?			59
Design Training Information Management System?			62
Analysis?			64
Conduct a task analysis?			66
Conduct a target population analysis?			76
Analyze Resource Requirements / Constraints?			78
Develop objectives?			98
Develop tests?			113
Review existing materials?			128
Design training?			131

**How to use this
handbook
(Continued)**

Do You Have To . . .	Yes	No	Page
Select Media?			137
Conduct training?			178
Conduct operational evaluations?			184
Validate training?			219
Conduct formative evaluations?			230
Conduct summative evaluations?			233

Chapter 2

INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

Overview

Introduction

Designing, developing, implementing, and supporting a training system requires considerable time and effort on the part of managers and instructional system developers. Developers must design, develop, and implement effective and efficient training, while managers must control, coordinate, and integrate the training into a total training system using the principles of Quality Improvement (QI). The total instructional system model includes the ISD phases, the system functions, and the QI process.

Objectives

The objectives of this chapter are to:

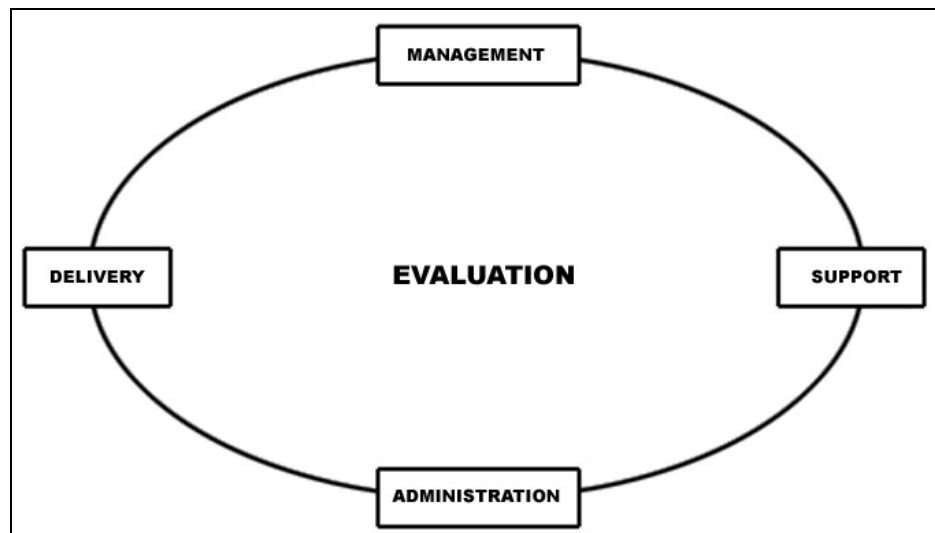
- Describe the phases of ISD.
- Discuss the system functions.
- Explain the QI process.

Updated Air Force ISD model

The updated ISD model has been designed to represent simplicity and flexibility so that instructional designers with varying levels of expertise can understand the model and use it to develop effective, efficient instructional systems. This model depicts the flexibility that instructional designers have to enter or reenter the various stages of the process as necessary. The entry or reentry into a particular stage of the process is determined by the nature and scope of the development, update or revision activity.

System functions

An extension of the systems approach places the ISD process within the functional design of a total instructional system. Figure 1 shows the basic top-level system functions of the instructional system: management, support, administration, delivery, and evaluation.

**System functions
(Continued)****Figure 1 System Functions**

Functions

The system functions of the ISD model are:

Management: The function of directing or controlling instructional system development and operations.

Support: The function of maintaining all parts of the system.

Administration: The function of day-to-day processing and record keeping.

Delivery: The function of bringing instruction to students.

Evaluation: The function of gathering feedback data through formative, summative, and operational evaluations to assess system and student performance.

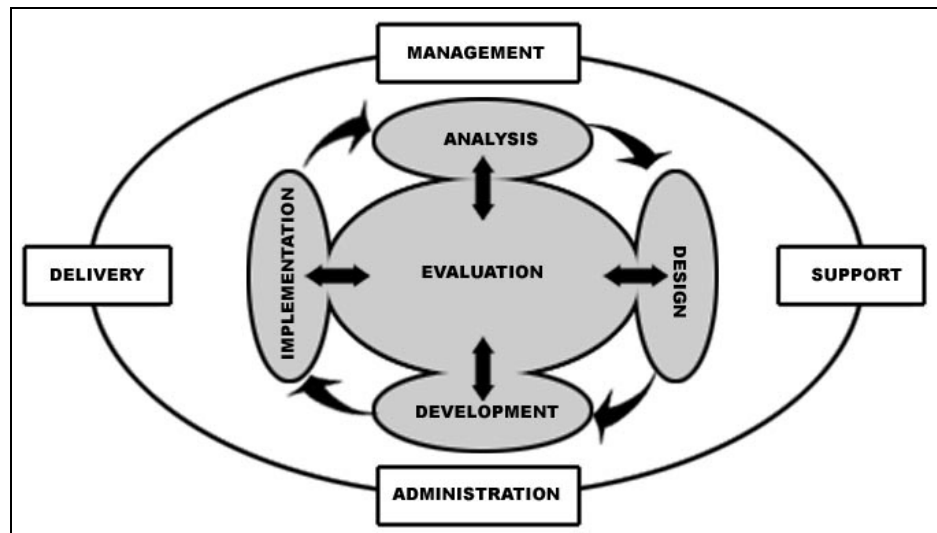
Relation to ISD

Using these essential functions to design the overall instructional system architecture and then allocating them to the respective instructional system components, or people responsible, ensures that these functions are operational when the total training system is fielded. ISD products are integrated into the total instructional system, and aspects of the instructional system functions are active throughout all phases of the ISD process.

**Relation to ISD
(Continued)**

Figure 2 shows the phases most often used in the systems approach, which are analysis, design, development, and implementation, with the evaluation activities integrated into each phase of the process. The phases are embedded within the system functions. Evaluation is shown as the central feedback "network" for the total system.

Figure 2 Functions with Phases



The instructional development process, which the model summarizes, calls for instructional designers to:

Analyze and determine what instruction is needed.

Design instruction to meet the need.

Develop instructional materials to support system requirements.

Implement the instructional system.

Evaluation is a central function that takes place at every phase.

Symbolically, Figure 2 shows that all phases of the model depend on each of the other phases. The ISD process allows the instructional designer or design team to enter or reenter the various phases of the process as determined by the nature and scope of the development or revision activity. The phases of the updated model are described below.

Analysis phase

In courses that tie the content directly to preparing a student to do a job, the instructional designer analyzes the job performance requirements and develops a task list. The designer then analyzes the job tasks and compares them with the skills, knowledge, and abilities of the incoming students. The difference between what they already know and can do and what the job requires them to know and be able to do determines what instruction is necessary. The activities of formative evaluation begin.

Design phase

In the design phase, the instructional designer develops a detailed plan of instruction, which includes selecting the instructional methods and media, and determining the instructional strategies. Existing instructional materials are reviewed during this phase to determine their applicability to the specific instruction under development. In this phase, the instructional designers also develop the instructional objectives and test and design the instruction. The implementation plan for the instructional system is developed in this phase and a training information management system is designed, if required. Formative evaluation activities continue in this phase.

Development phase

In the development phase, both the student and instructor lesson materials are developed. If the media selected in the design phase included items such as videotapes, sound/slides, interactive courseware (ICW), and training devices, these are developed. If a training information management system was developed for the instructional system, it is installed in this phase. As a final step in this phase, the implementation plan is updated. During this phase, instructional designers also validate each unit/module of instruction and its associated instructional materials as they are developed. They correct any deficiencies that may be identified. Validation includes:

- Internal review of the instruction and materials for accuracy
- Individual and small-group tryouts
- Operational tryouts of the "whole" system

Revision of units/modules occurs as they are validated, based on feedback from formative and summative evaluation activities. The final step in this phase is to finalize all training materials.

Implementation phase

The instructional system has been designed and developed, and it is now time for the actual system to become operational. In this phase, the instructional system is fielded under operational conditions and the activities of operational evaluation provide feedback from the field on the graduate's performance.

Evaluation

Evaluation is a continuous process beginning during the analysis phase and continuing throughout the life cycle of the instructional system. Evaluation consists of:

Formative Evaluation, consisting of process and product evaluations conducted during the analysis and design phases, and validation, which is conducted during the development phase. Included are individual and small group tryouts.

Summative Evaluation, consisting of operational tryouts and conducted as the last step of validation in the development phase.

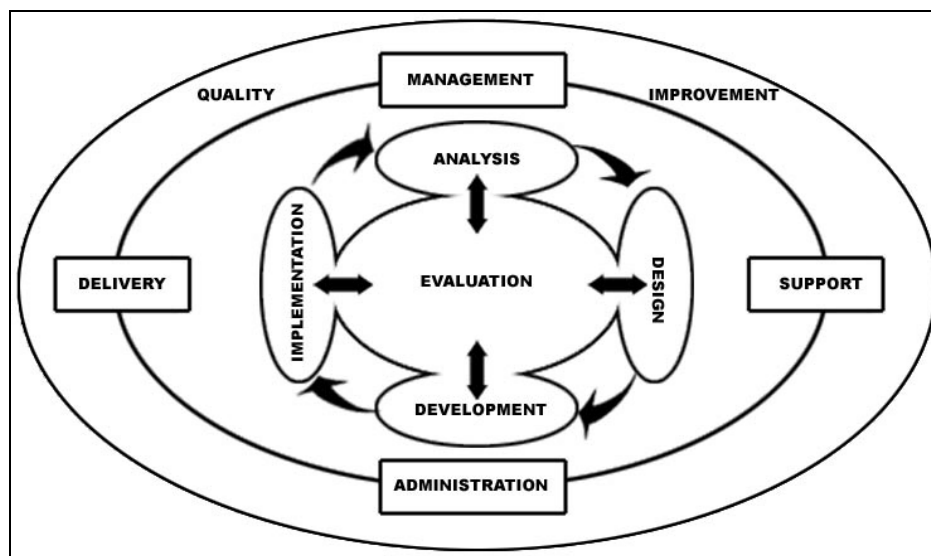
Operational Evaluation, consisting of periodic internal and external evaluation of the operational system during the implementation phase.

Each form of evaluation should be used during development, update, and revision of instruction, if possible, and if the form of evaluation is application.

Quality improvement

Figure 3 depicts the completed ISD model. This completed figure shows the system functions and ISD phases embedded within the quality improvement (QI) process.

Figure 3 Updated AF ISD Model



The QI process, which is further discussed in this chapter, is briefly described below.

Quality improvement is the continuous, organized creation of beneficial change to the system. The objective of quality improvement is to foster continuous improvement in the process and products of ISD. It is an independent evaluation to determine whether the products are meeting the users' needs. The objective of quality improvement is to ensure on-time development of high-quality courseware that enables students to reach the desired performance levels in an effective and cost-efficient manner.

The updated model graphically illustrates that:

Evaluation is the "centerpiece" to the ISD process. ISD is a continuous process with the flexibility to enter and reenter the various phases, as necessary, to develop, update, or revise instruction.

**Quality
improvement
(Continued)**

All ISD activities take place within and are dependent on the system functions.

Teamwork is required between personnel performing system functions and those designing, developing, and implementing instructional systems.

All ISD activities and system functions focus on continuous quality improvements in the system.

**Where to read
about it**

This chapter contains seven sections.

Section	Title	Page
A	Analysis	16
B	Design	18
C	Development	20
D	Implementation	22
E	Evaluation	23
F	Total Training System Functions	25
G	Quality Improvement	26

Section A Analysis

What is it?

During analysis, you:

Collect information on missions/jobs/duties/tasks.
Analyze the information.
Determine job performance requirements.

Why do it?

You conduct analysis to **identify the training needs** so training can be developed to meet those needs.

Where to read about it

Details on the analysis phase of ISD are available in Chapters 3 and 4. Specific topics are listed below.

Title	Page
Analyze Training Needs	45
Conduct Task Analysis	66
Conduct Target Population Analysis	76
Analyze Resource Requirements/Constraints	78
Update ISD Evaluation Plan	83
Update Training Development Plan	85

When you do it

Conduct an analysis before you begin to design new or revise existing training.

What you get

If you have conducted the analysis correctly, you will get valid training requirements and accurate predictions of the resource requirements.

What you need

To conduct analysis, you need to assess:

- Equipment
- Subject matter experts (SMEs)
- Weapon system data
- Existing course materials
- Technical data
- Occupational Survey Report (OSR) data
- Engineering data
- Similar system or programs
- Training standards

Section B Design

What is it?

Training design is like architectural design. You figure out what you want the training to look like and how you want it to work. The analysis that you previously conducted will help determine the design of the training in this phase.

Why do it?

The purpose of design is to be sure that the product teaches. If a product does not teach it has no value. Supposedly a designer knows what is effective in promoting learning for different kinds of outcomes. The designer then builds into the instruction those conditions that are necessary for effective and efficient learning to occur. If these conditions are not built into the materials then there is strong likelihood that the materials will not teach.

The additional benefits of design are to save money, increase product quality, and **get the training done on time**. You don't just go out and start **developing** instruction, just as you don't start building a training facility without **planning** and **designing** it first.

Where to read about it

Details on the design phase of ISD are available in Chapter 5. Specific topics are listed below.

Topic	Page
Review Types of Learning	88
Select Training Methods	94
Develop Objectives	98
Develop Tests	113
Review Existing Materials	128
Design Training	131
Update Training Development Plan	144

When you do it

Design the training system before beginning to develop training.

What you get

Proper design will result in:

- Training objectives
- Tests that measure the objectives
- Training methods, media, and strategies to deliver the training
- Training information management systems

What you need

For ISD design, you need all the products developed during initial project planning and the analysis phase.

Section C Development

What is it?

During this phase, training is developed including all training materials. After the training has been developed, follow-on evaluation (validation) phase ensures that each component is contributing to the overall effectiveness and efficiency of the training system.

Why do it?

Development is the production of the materials. Without development there is no instruction except perhaps in the case of extemporaneous, live instructions. Technology production (development) has become a highly specialized area with different people needed for different aspects of the production (artists, technical writers, computer programmers, web site designers, etc.)

The purpose of development is to have a valid product ready for implementation.

Where to read about it

Details on the development phase of ISD are available in Chapter 6. Specific topics are listed below.

Topic	Page
Prepare Course Documents	147
Develop Training Materials	157
Develop Training Alternatives	161
Install Training Information Management System	162
Update ISD Evaluation Plan	163
Update Training Development Plan	165
Finalize Training Materials	166

When you do it

Develop training after it has been designed and before it is implemented.

What you get

Properly developed training results in training that meets the design specifications.

What you need

For development you need:

Analysis and design documents and products
Students and equipment for validation

Section D Implementation

What is it?

In this phase, the training system that has been designed and developed is implemented and the system produces graduates.

Why do it?

Implementation produces graduates who have been trained to meet a specific need.

Where to read about it

Details on the implementation phase of ISD are available in Chapter 7. Specific topics are listed below.

Topic	Page
Implement Training System Functions	170
Conduct Training	177
Conduct Operational Evaluation	183
Revise Courseware	207

When you do it

Training is implemented after it has been validated and revised.

What you get

Successfully implemented training results in graduates who meet the job performance requirements.

What you need

For implementation you need:

Finished training product
All training system functions in place

Section E Evaluation

What is it?

Evaluation measures the quality, effectiveness, and efficiency of the training system. Evaluation answers the questions:

Is the process effective and cost-efficient?
Are quality products being developed?
How well are the course graduates performing on the job?
How can the system be improved?

Why do it?

Evaluation improves the quality of the ISD process and products while producing graduates who can meet job performance requirements.

Where to read about it

Details on evaluation of ISD are available in Chapter 8. Specific topics are listed below.

Topic	Page
Validate Training	218
Formative Evaluation	230
Summative Evaluation	234
Operational Evaluation	235

When you do it

Evaluation begins in the initial planning stages of the ISD project and continues throughout the life cycle of the system.

What you get

Evaluation provides data on the quality of the ISD process and products and determines whether graduates are meeting job performance requirements.

What you need

To properly perform evaluation you need:

- Evaluation plan
- Completed ISD activities
- ISD products
- Operational system
- Graduates
- Evaluator

Section F

Total Training System Functions

What are system functions?

The system functions must be in place before a training system can be properly operated and maintained.

The basic training system functions are shown below.

Function	Description
Management	The practice of directing and controlling all aspects of the training system.
Support	Provides for and maintains the training system on a day-to-day and long-term basis. Examples are resources you need to keep equipment functioning.
Administration	The part of management that performs day-to-day tasks such as documentation, student assignments, and student records.
Delivery	The means by which training is provided to students. Instructors, computers, printed materials, audio, visual programs are all examples of training delivery methods.

When you implement

System functions must be in place and working before the training system is implemented. These functions will support the training system throughout its life cycle.

Section G

Quality Improvement

Introduction

ISD is a cyclic, systematic process that continually evaluates the instructional system throughout its life cycle. The Air Force uses the ISD process as a tool to ensure that instructional systems deliver quality instruction to Air Force personnel in the most effective and efficient manner possible. The ISD process implements the principles of the Quality Air Force (QAF) program.

What is it?

Quality improvement (QI) is the continuous, organized creation of beneficial change to the system. It is an independent evaluation to determine whether the instructional products are meeting the students' needs.

Objectives of QI

The objective of quality improvement is to foster continuous improvement in the products and processes.

Results

Quality **instructional product development** results in:

- Increased student satisfaction
- Products that are easy to use and maintain
- An increase in the students' ability to perform on the job

Quality **instructional design** results in:

- Fewer errors
- Less rework (and waste)
- Higher success training
- Less time spent in development of new training products
- Lower life cycle costs

ISD and quality relationship

The principles of quality are implemented in the ISD process, resulting in total quality in the education and training environment by continuously evaluating the processes and products. The relationship between the key concepts of QI can be easily seen in the ISD process.

ISD examples

ISD examples are:

Customers:

Know your customers. The information gained in the mission/job analysis process gives the instructional design team information that defines the customer's expectations.

Focus on customers. As mentioned earlier, the needs of the work center drives the instructional needs. By continuing to trace the relationship between the job requirements and all aspects of the instructional program, you maintain a continual focus on the actual field requirements. In addition, ISD also requires that the capabilities, aptitudes and attitudes of the student target population be considered during the design process.

Team Players:

Foster teamwork. A training program cannot be designed and developed in a vacuum. In order to develop effective training, the design team must include representatives from the work center and evaluation offices. This helps ensure that the training matches the performance requirements of the job.

Empower your people. ISD is a problem solving, decision-making model. The flexibility of the process, combined with the fact that there are any number of ways to solve a given training problem, requires that design teams be allowed freedom and authority to design, develop, and implement training that meets job performance requirements.

Final Product:

Know your mission. ISD depends on mission and job analysis for basic data. All instruction **must** be based directly on mission or job requirements. The checks in the process help eliminate instruction not related to the job.

Job analysis uses data from many sources, including mission statements found in regulations or locally developed statements. Analysts also make use of management engineering reports, occupational survey data, and direct observation to determine the actual job requirements.

**ISD examples
(Continued)**

As part of the job analysis process, a training needs assessment is conducted to arrive at the actual performance

problem. In some cases, a problem is not related to lack of training, but to a problem with the job structure or environment. The ISD process helps ensure that you don't build a training program for a non-training problem.

Set goals and standards. Goals and standards for an instructional development effort come in many variations. First, the job requirements and the impact of the performance deficiency determine the timing required for the development process and the conduct of the instructional program. Second, the content of the training is determined by the job performance requirements. The design team should directly translate the cues, conditions, and performance standards of the job directly into the instructional program.

Manage by fact. Each phase of the ISD process requires constant evaluation against the job requirements identified earlier in the process. In addition, a variety of tools have been developed to help ensure that design and development decisions are made with supporting data. For example, a number of media selection tools are being used that provide managers with information that matches training media with the training requirements. These matches are based on learning theories and development cost factors (money and time). ISD is designed to guide managers and developers to awareness of factors affecting their decisions.

Integrate quality in all phases. Evaluation is continuous quality checking. This is true during each phase of the ISD process, from analysis to implementation. Built-in checks in each phase ensure the quality of the ISD process and products. The emphasis is on satisfying the job performance requirements and producing graduates who can do their jobs.

Evaluate quality constantly. The ISD process is a cyclical, ongoing process of continuous improvements. As curriculum developers progress through the different phases of ISD, the process and products of each phase are constantly evaluated against the job requirements and principles of learning. The

**ISD examples
(Continued)**

results of the evaluations determine which phase of ISD to enter next. Constant evaluation identifies changes in job requirements due to updates in equipment and personnel, which results in new ISD efforts to provide the best possible training to Air Force personnel.

**Other ISD
examples**

Other ISD examples are:

Set goals and standards. The goals and standards for an instructional development effort come in many variations. First, the job requirements and the impact of the performance deficiency determine the timing required for the development process and the conduct of the training program. Second, the content of the instruction is determined by the person's need to do the job. The design team must directly translate the cues, conditions, and performance standards of the job directly into the instructional program.

Manage by fact. Each phase of the ISD process requires constant evaluation against the job requirements identified earlier in the process. In addition, a variety of tools have been developed to ensure that design and development decisions are made with supporting data. For example, a number of media selection tools are being used which provide managers information that matches training media with the instructional requirements. These matches are based on learning theories and development cost factors (money and time). ISD is designed to guide managers and curriculum developers to awareness of factors affecting their decisions.

Integrate quality in all phases. Evaluation is continuous. This is true during each phase of the ISD process, from analysis to implementation. Built-in checks in each phase ensure quality of the ISD process and instructional products, with emphasis on the graduate's performance.

Evaluate quality constantly. The ISD process is a cyclic, ongoing process. As curriculum developers progress through the different phases of ISD, the process and products of each phase are constantly evaluated against the instructional requirements and principles of learning. Results of the

**Other ISD
examples
(Continued)**

evaluations determine which phase of ISD to enter next. Constant evaluation identifies changes in instructional requirements due to updates in equipment and personnel, which results in new ISD efforts to provide the best possible instruction to Air Force personnel.

**Basis of process
improvement**

The basis of process improvement is Quality Air Force (QAF). QAF is a management philosophy and a methodology that work together to produce continuous process improvements. It is based on ten principles:

All work is a process.

Processes receive work from suppliers, add value and deliver output to customers.

Anyone from whom a process receives work is a supplier.

Anyone to whom a process delivers output is a customer.

Customers have needs and expectations.

Customers will define and measure quality in terms of those needs and expectations.

Quality is meeting customer needs and expectations.

Improving process quality increases productivity.

Processes can be identified, understood, measured, and improved.

The people who operate the processes know best how to improve them.

**Procedure for
process
improvement**

In order to ensure process improvements, you will need to use a systematic method to identify and correct the causes of the problems. The six steps of process improvement are outlined in the next table.

Step	Activity
1	Define the process and determine the main problem areas.
2	Analyze the problems and identify the causes of each.
3	Identify and evaluate possible changes to the process.
4	Implement the changes and monitor the process.
5	Institutionalize the changes.
6	Repeat for continuous improvements.

**Ways to implement
the procedure**

There are many different ways to implement the basic procedure mentioned above. Two of the ways are:

"Chart It, Check It, Change It"
Shewhart Cycle (plan-do-check-act)

Each of these techniques uses the six basic steps mentioned above.

"Chart It, Check It, Change It"

What it is

This technique is a systematic approach to continuous improvement. This approach has three principal steps, as shown below and in Figure 4.

Step	Name	What You Do
1	Chart It	Describe the process. Gather data.
2	Check It	Analyze the data. Evaluate the process. Identify opportunities.
3	Change It	Improve the process. Institutionalize the change.

How to use it

Chart It

Using a process flowchart, describe the process to be improved.
Gather data on the process and its products.

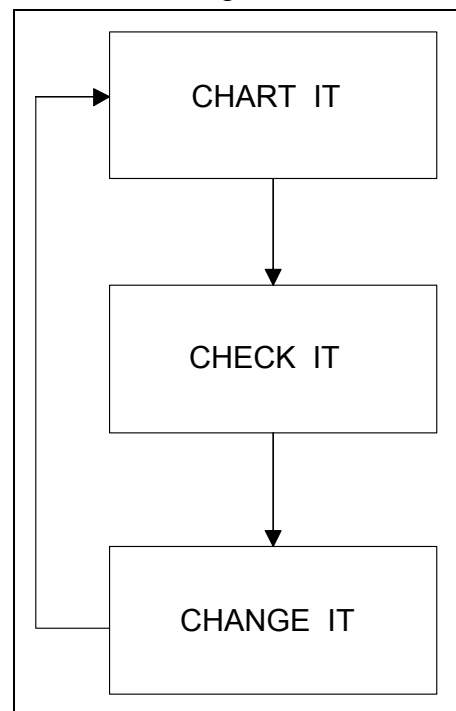
Check It

Analyze the data to isolate the problems and opportunities.
Evaluate the process to identify alternative approaches.
Identify opportunities (i.e., useful changes) from the alternatives.

Change It

Improve the process by implementing changes identified as opportunities.

Figure 4 Chart it, Check it, Change it



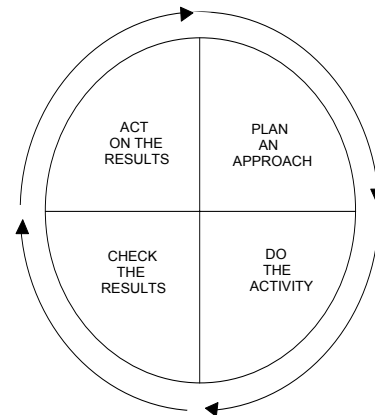
Institutionalize the changes through training, standardization, etc. Then, use another process (or use this same one again) to make further improvements.

"Shewhart Cycle"

What it is

The Shewhart Cycle is a systematic approach to achieving a continuous improvement in quality. The cycle includes planning, doing, checking, and acting. Because the approach involves repetition, it is represented graphically as a circle in Figure 5.

Figure 5 Shewhart Cycle



How to use it

To use the Shewhart Cycle, follow the steps listed below.

Plan an approach for quality improvement. Study the process flow and any existing data. Formulate possible improvements, experiments to be run, or additional data to be gathered.

Do the activity planned. Implement the improvement effort that you planned. Train the people who are responsible for implementation.

Check the results. Measure the results of the improvement effort you implemented. Analyze the data you collected.

Act on the results. If the effort was truly an improvement, standardize and document it. If it wasn't successful, determine what could be done to improve it.

Repeat. Continue around the cycle again by planning and carrying out further activity.

Flowchart: A process improvement tool

Many tools are used to make process improvements. One tool that is often used to analyze process problems is the flowchart.

What it is

A flowchart is a graphical representation of all the major steps of a process. It can help you:

- Understand the complete process.
 - Identify the critical stages of the process.
 - Locate problem areas.
 - Show relationships between different steps in a process.
-

How to use it

Points on how to use it:

Identify the process. Define the start point and finish point for the process to be examined.

Chart the ideal process. Try to identify the easiest and most efficient way to go from the start block to the finish block. While this step isn't absolutely necessary, it does make it easier to find improvements.

Describe the current process. Chart the whole process (i.e., lay out all the steps) from beginning to end. You can use standard symbols to improve the clarity of your flowchart.

Search for improvement opportunities. Identify all areas that hinder your process or add little or no value. Examine all areas that differ from your ideal process and question why they exist.


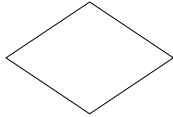

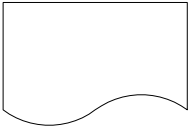

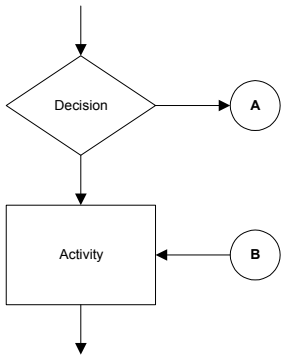
Update your chart. Build a new flowchart that corrects the problems you identified in the previous step.

Standard flowchart symbols

Figure 6 depicts the standard flowchart symbols.

Standard flowchart symbols
(Continued)

Figure 6 Standard Flowchart Symbols

This symbol...	Represents...	Some examples are...
	Start/Stop	Receive tasking to develop training. Complete training development process.
	Decision Point	Approve/Disapprove. Yes/No. Develop training/non-training solution.
	Activity	Develop objective. Develop test. Product training materials.
	Document	Fill out task analysis worksheet. Update training development plan. Document evaluation results.
	Connector (to another page or part of the diagram.)	

Using process improvement methods

There are numerous process improvement tools that can be used to document and improve the aircrew training development process. As managers and curriculum developers, you are encouraged to use a process improvement tool such as flowcharting any time you are involved in developing a new process or revising an existing process. Also, if you haven't documented your current training development process, it is recommended that you do so in order to improve the process.

**Example of the
training
development
process**

Figure 7 depicts the overall training development process used to develop aircrew training. You may want to adapt this flowchart to the specific or unique needs of your training organization.

Figure 7 (Part 1) Training Development Flowchart – Planning

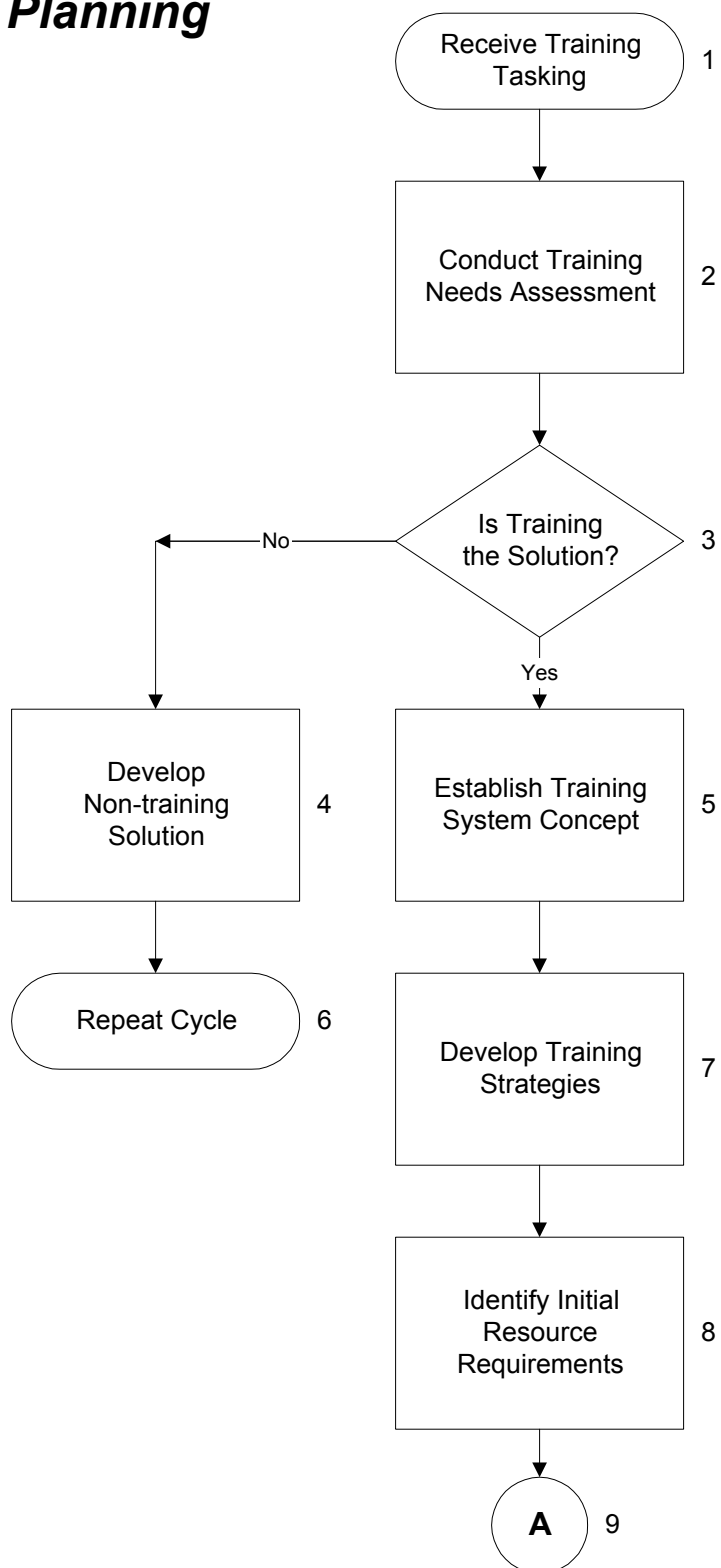
Planning

Figure 7 (Part 2) Training Development Flowchart – Analysis

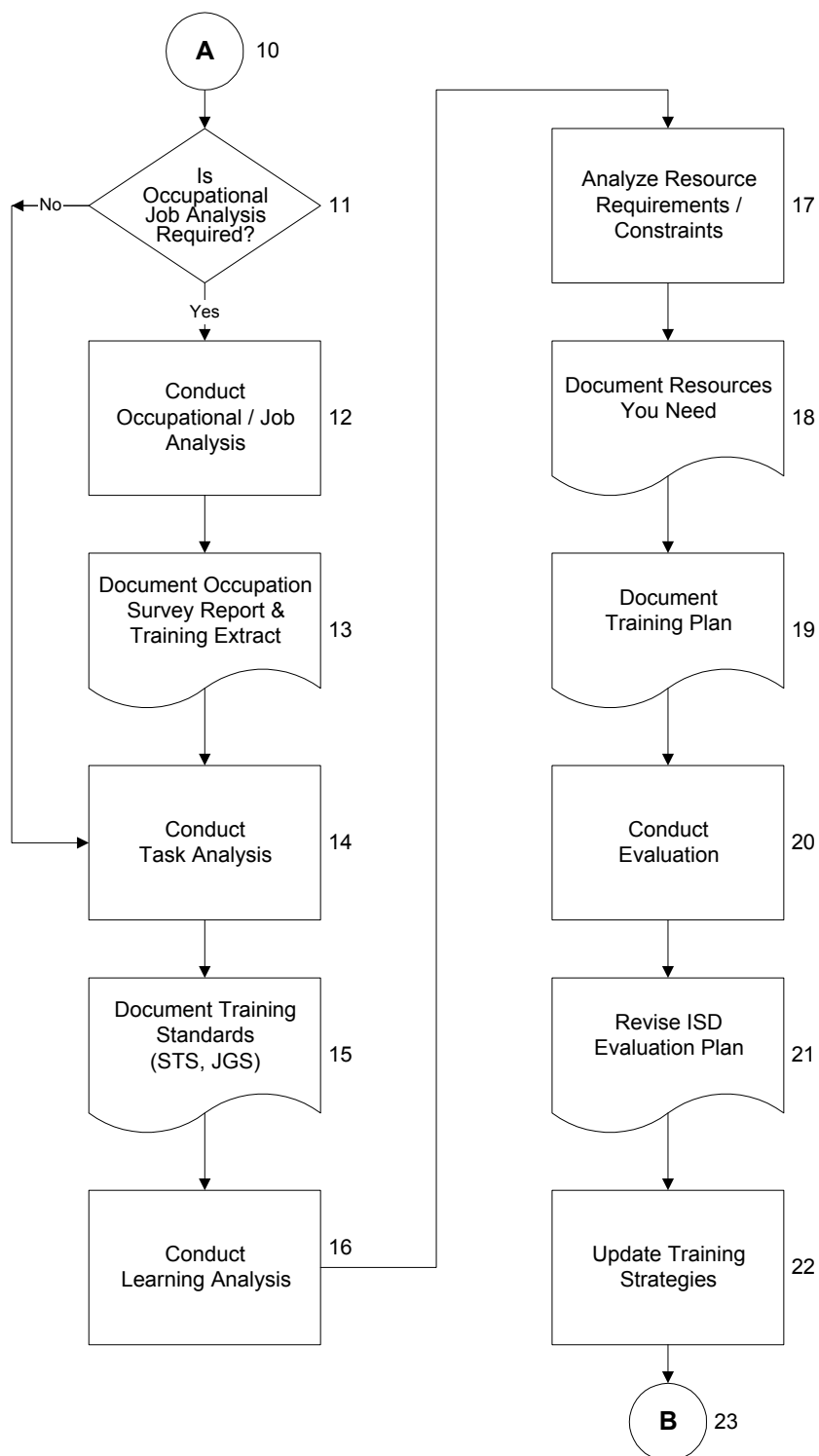
Analysis

Figure 7 (Part 3) Training Development Flowchart – Design

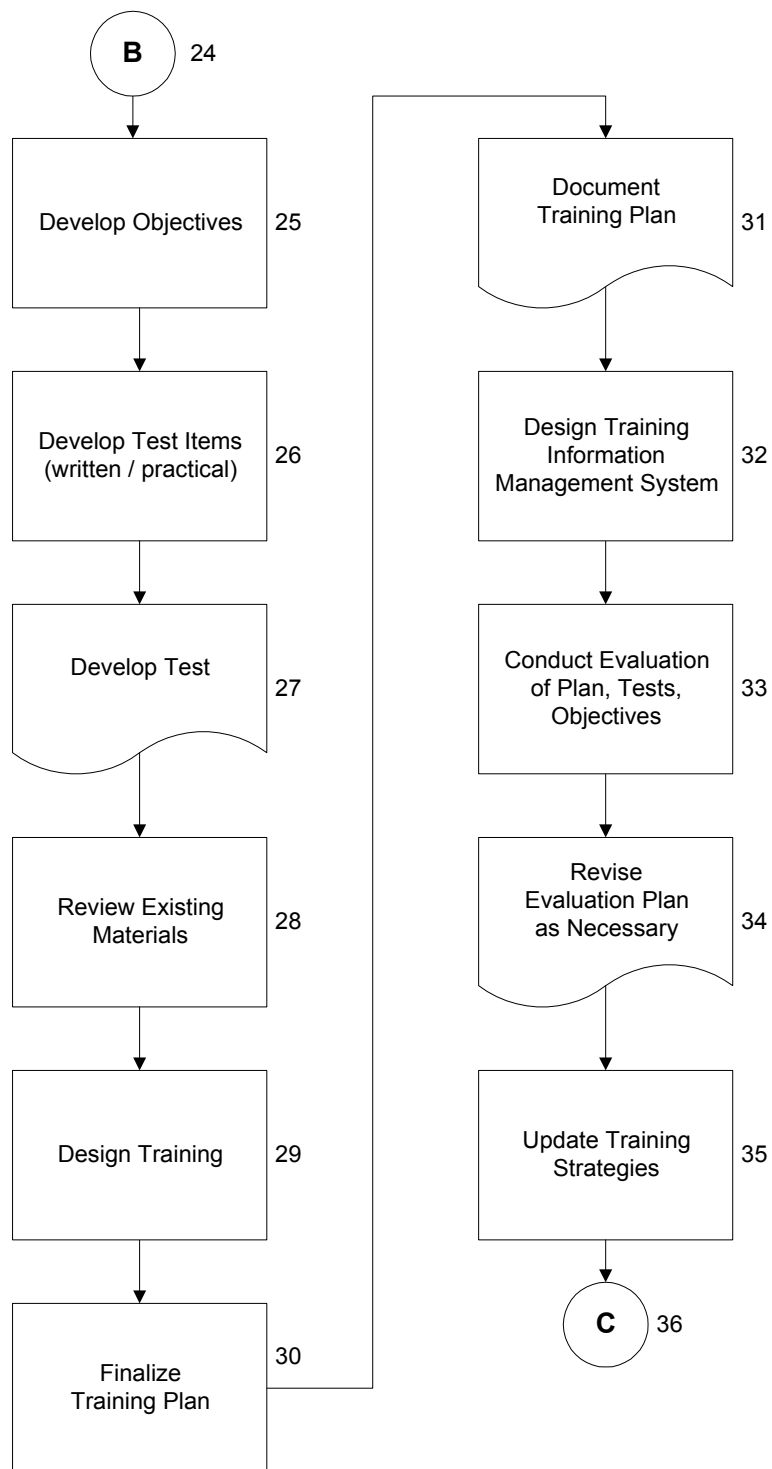
Design

Figure 7 (Part 4) Training Development Flowchart – Development

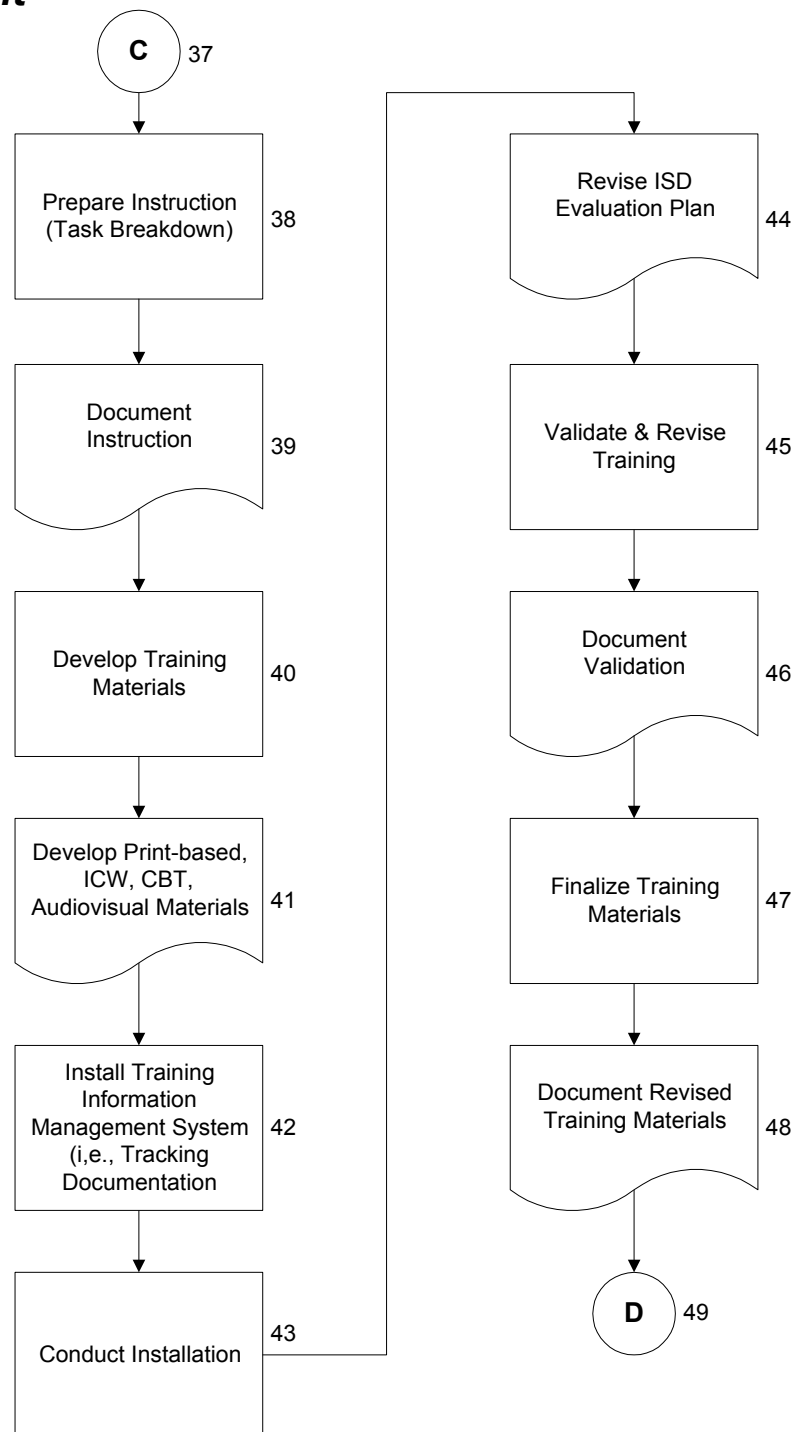
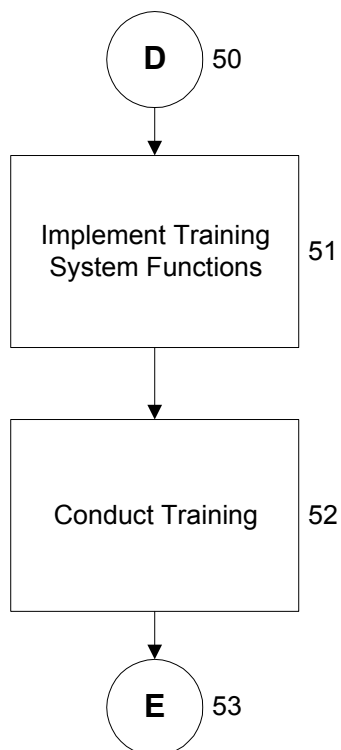
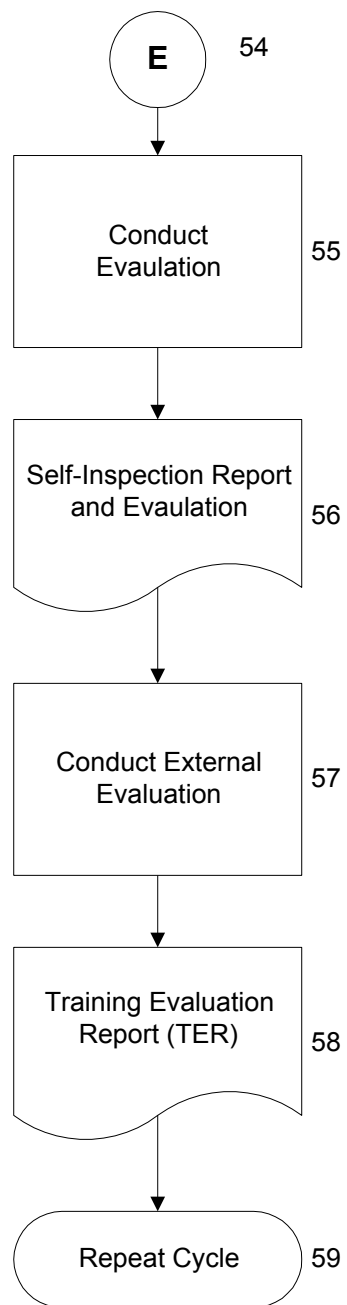
Development

Figure 7 (Part 5) Training Development Flowchart – Implementation and Evaluation

Implementation***Evaluation***

Metrics

Metrics are standards of measurement or quality indicators that are critical to maintaining quality in the training development process. The purpose of metrics is to provide qualitative and quantitative evaluations of the process and products within each phase of ISD. Metrics are based on key factors such as performance, cost, and schedule. Types of metrics include, but are not limited to, items such as:

Qualitative:

- Directives
- Evaluation criteria
- SME review
- Format guide

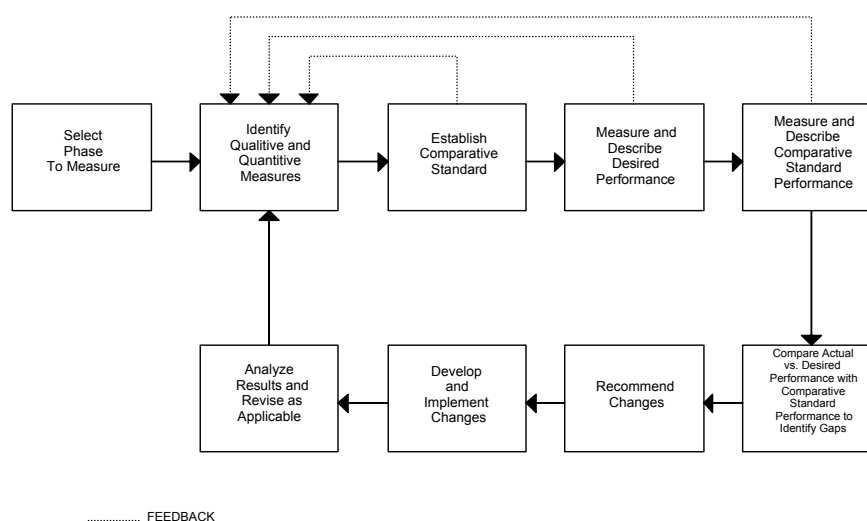
Quantitative:

- Personnel/skill allocation
- Schedule
- Test and evaluation data

Training system metric process

Figure 8 depicts a typical metric process that can be used to develop and measure aircrew training. It can be modified to meet specific needs.

Figure 8 Training System Metric Process



Chapter 3

PLANNING

Overview

Introduction

Planning is a key element in the overall management of a training system as well as the ISD process itself. Proper planning has the same basic system functions of management, support, administration, and delivery. As a curriculum developer, you may not be involved in the overall planning for the training system; however, you still play a vital role in analyzing the training needs and providing information to the planners as well as identifying situations where inadequate planning has occurred. You also play a more active role in planning for the design and development processes.

Objectives

The objectives of this chapter are to:

- Conduct training needs analysis.
- Determine personnel requirements and responsibilities.
- Discover training needed to meet requirements.
- Determine training system requirements.
- Plan and execute ISD management and evaluation plans.
- Design and update the Training Information Management System

The lack of planning is costly.

Where to read about it

This chapter contains seven sections.

Section	Title	Page
A	Analyze Training Needs	45
B	Determine Personnel Requirements and Responsibilities	48
C	Determine Training Needed to Meet Requirements	51
D	Determine Training System Requirements	53
E	Develop ISD Evaluation Plan	55
F	Write Training Development Plan	60
G	Design Training Information Management System	63

**Additional
information**

For additional information on planning, see:

AFMAN 36-2234, Instructional System Development.
Knirk, F. G. and Gustafson, K. L. (1986). *Instructional
Technology: A Systematic Approach To Education*. New York:
Holt, Rinehart, and Winston.
Rossett, A. (1987). *Training Needs Assessment*. Englewood
Cliffs, New Jersey: Educational Technology Publications.

Section A

Analyze Training Needs

Introduction

The planning phase of training development normally begins with a needs analysis to make sure that the stated problem or identified deficiency can be solved with training. Training will solve only certain types of performance deficiencies. They are the performer's lack of ability to recall information and lack of knowledge, skill and ability to perform a task and the attitude or willingness to perform. If the identified performance deficiency does not fall into one of these areas, training cannot solve it, and thus there is no need to proceed further with the training development effort.

Purpose

Although often confused, there is a distinct difference between a "needs assessment" and a "training needs assessment." For this reason, the purpose of each is given.

Needs Assessment – The process of analyzing a problem or deficiency in order to determine if the solution is training or non-training related.

Training Needs Assessment (TNA) – The process of identifying the deficiency or "gap" between current performance and desired performance as part of the analysis phase. This gap equates to or identifies the training need.

Who is responsible?

Curriculum developers are responsible for conducting the needs assessment, as well as the training needs assessment, if necessary.

When do you conduct TNA?

Needs or training needs analysis should be one of the first tasks accomplished in the analysis phase. It is important to do the assessment first, since the problem or deficiency may not have a training solution, which means that proceeding with training development would be inappropriate.

Receiving the tasking

The request to do a needs assessment usually comes from a higher headquarters in the form of a tasking letter, message, or memo. Also, a needs assessment can be initiated by the curriculum developer as a result of analyzing critiques of an existing course.

Possible causes of problems

Several possible causes of performance problems are:

- Personnel were never trained.
- Personnel did not receive follow-up training after the initial training.
- Correct training was not provided during the initial training.
- Personnel are not allowed to perform their jobs correctly.
- Personnel disregard the rules.

Identifying a need

The requirement to do a needs or training needs analysis can come from many different sources. Most needs are identified because individuals are not meeting job performance requirements. This situation is often caused when job requirements change as a result of new equipment or job tasks. Several sources for identifying training needs are:

- Job evaluations
- Course critiques
- Field inputs
- Accident board findings

How to do a needs assessment

The needs assessment process is accomplished in several stages. The number of stages will vary, depending on the assessment being done. However, for explanation purposes, six stages will be used to describe the process.

Stage 1 – **Define the purpose of the assessment.** Identify information such as who is involved, what the problem is, or who wants the problem solved.

Stage 2 – **Identify the data sources** to be used in the assessment, such as evaluation reports, critiques, and subject matter experts (SMEs).

How to do a needs assessment

Stage 3 – **Select data gathering instruments** such as questionnaires, interviews, or direct observations.

Stage 4 – **Collect data** by sending out questionnaires, or conducting interviews.

Stage 5 – **Analyze the data** by comparing the present performance against the desired performance. Also, confirm the accuracy and quality of the data gathered.

Stage 6 – **Document findings and recommend solutions.** Document the problems, identify the causes, explain the gap or deficiency between the present and desired performance, and recommend a solution.

Non-training solution

If the curriculum developer determines that the deficiency in job performance is not training-related, such as equipment obsolescence, a non-training solution should be pursued. Once a solution has been found, it should be sent back to the organization requesting the needs analysis.

Section B

Determine Personnel Requirements and Responsibilities

Introduction

Once it has been determined that training is needed, determining personnel requirements and responsibilities becomes a key factor in getting ready to apply the ISD process to aircrew training development. In this process you will identify information such as the types of people you need to develop the training, the skills they should have, the number of people you need, when you need them, and their responsibilities. As you can see, there are several factors to be considered when determining personnel requirements and responsibilities.

Purpose

The purpose of determining personnel requirements and responsibilities is to ensure that the personnel required to design, develop, implement, and maintain the training system are identified and their responsibilities are defined.

Who is responsible?

Curriculum developers and their supervisors are normally responsible for identifying personnel requirements for the training system. During this process, the responsibilities of the individuals are also identified.

When do you determine requirements and responsibilities?

Determining training system personnel requirements and their responsibilities is one of the first stages, if not the first, in initial ISD project planning. This task should be done as early as possible to ensure that the right people, with the right skills, in the right numbers, are available at the right time to develop the training.

What is required?

In order to determine personnel requirements and responsibilities, several tasks must be performed:

- Determine the scope and level of the project.
- Identify the need for personnel such as the SME.
- Define the role of the personnel required.

Each of these tasks will be discussed further.

Scope and level of the project

The scope and level of the ISD project will determine the personnel requirements. For example:

Developing initial and continuation training courses for a new defense system will normally require more personnel than revising training in an existing course.

Developing a course using interactive courseware (ICW) will require more personnel, using different skills, than are required for print-based materials.

Levels of complexity within ICW will impact personnel requirements since the more complex the material, the more time it takes to design and develop.

Using a multimedia approach in a course(s) will impact the type, number, and skills of personnel needed to develop the training. In one case you may need computer programmers while in another case you may need graphic artists, sound engineers, and photographers.

Early in the planning stage, you may not be able to define the exact scope and level of the ISD project. However, as you enter the actual analysis and design phases of training development, the scope and level of training will be clearly defined, allowing personnel requirements to be determined.

Define the scope and level of the ISD project early in the initial planning stages.

Identifying need for SMEs

Once the scope and level of the ISD project have been adequately defined, you may need content specialists to provide the technical expertise (pilots, weapon system officers). Sometimes these SMEs are not available and someone from the weapon system or similar system will require training to perform as the SME.

When identifying personnel requirements, you should:

Identify the specialties that are needed for the project.
Indicate the number of each specialty required.

Identifying need for SMEs (Continued)

List any special skills the specialist may need.
Estimate when specific specialists will be needed and for how long.
Identify how they will retain currency, if necessary.

Identification of specialists should be completed as soon as possible to ensure that the specialists needed on the project have sufficient time to schedule their work on the project. In cases where a specialist may need to be permanently assigned to the project, early identification of personnel is essential. This allows sufficient time for the assignment process to work, which can take several months in some cases.

Define roles

Once you have established the need for an SME, you should clearly define that person's role in the project. Clearly defined roles will:

- Enable the elements of the project to be more accurately defined, such as project definition, tasks, milestones.
- Allow specialists to know their role as members of the project development team.
- Allow work to be scheduled with minimum conflict.
- Allow specialists to be selected who have the needed skills.

You may not be able to totally define the role of each specialist in the project until the training system design has been established.

Section C

Determine Training Needed to Meet Requirements

Introduction

At this point in the process of getting ready to apply ISD to develop aircrew training, the training needed to meet the requirements should be determined. It is important to identify the necessary training as early as possible in the planning stages so that adequate preparations can be made to design and develop training that will meet system requirements.

Purpose

The purpose for determining the training needed to meet system requirements is to identify types of training, such as performance or complex performance. Identification of needed training will enable the instructional developer to more accurately design an instructional system based on the effect the type of training will have on training system components such as equipment, facilities, time, media, methods, aircraft, ranges and ordnance.

Who is responsible?

Curriculum developers are responsible for determining the training that is needed to meet requirements of the training system.

When should it be done?

Determining the needed training to meet requirements should be done during the initial planning stages of the ISD project. The training needed should be determined prior to making preliminary decisions such as methods, media, and training alternatives. Refer to AFH36-2235, Volume 3, for the schedule of planning activities.

How should it be done?

During initial ISD project planning, you will not be able to determine all of the training needed to meet the system requirements. As the training system design begins to take shape you will be better able to identify the types of training required. However, you may not have the luxury of time due to weapon system bed-downs. When this occurs, there are several ways to initially identify the training that may be needed.

**How should it be
done? (Continued)**

Compare the training system you intend to design with a similar system that already exists. This will help identify the types and levels of training that may be required. Be sure to include lessons learned by the similar training system.

Review existing information and technical data to determine what types of training may be required for the system.

Check Air Force directives to determine if they require specific training to specified levels to meet established requirements.

Use your experience and the experience of SMEs to identify possible training performance requirements.

Section D

Determine Training System Requirements

Introduction

Prior to applying the ISD process to develop aircrew training, some initial planning will need to be done to set the stage for the development project. Part of the initial planning is to determine the requirements of the training system. Since the requirements identified at this point are preliminary, they may need to be revised during the actual training development process. Additional information on determining training system requirements, system training plans (STP) and training planning teams (TPT) is found in AFH 36-2235, Volume 3.

Purpose

The purpose of identifying the training system is to establish the "framework" for building the training system.

Who is responsible?

Determining the training system requirements is the responsibility of the training planning team (TPT).

When should it be done?

Determining the training system requirements should be done during the initial planning and preparation of the ISD project. You should have an idea of the system requirements before starting the analysis of ISD.

What should be determined?

Determining training system requirements includes:

Assessing technology and methodology. This includes looking at the technology that is available and the new methodology or procedures that have been developed in order to determine how they might be used to meet training system requirements.

Making preliminary methods and media selection. The preliminary selection of methods and media is a "best guess" which allows further planning and design activities to proceed, such as determining training alternatives.

Examining training alternatives. This includes looking at the anticipated training system and selecting alternative ways to provide training in the event the primary training delivery system is rendered ineffective. Determining training alternatives is further explored in the next topic.

Select Training Alternatives

Introduction

During planning for the ISD project, curriculum developers initially examined possible training alternatives and in the analysis phase the need for alternative training strategies was determined. At this point, the training alternatives are selected, if applicable.

Purpose

The purpose of selecting a training alternative is to have an alternative method of providing training in case the primary delivery system is not available for training. For example, if the primary delivery for a particular lesson is the flight simulator, and it is not available, an alternative way of providing the training may be the actual aircraft or a part-task trainer.

Who is responsible?

Curriculum developers and SMEs are responsible for selecting alternative methods and media for providing training in their courses. Management within the training organization has the responsibility for ensuring that the training alternative selected is acceptable and meets the training goals of the organization.

When should alternatives be selected?

Training alternatives should be selected after the objectives and tests have been developed and you know what it is you are going to teach. Ideally, this activity is accomplished at the same time the methods and media are selected, since they may help you select training alternatives.

What should be done?

When selecting training alternatives, consider:

- Objective(s) to be trained using the alternative
- Effectiveness of using the alternative to deliver training
- Resource requirements of the alternative
- Training environment in which the alternative will be used
- Cost-efficiency of the alternative

Section E

Develop ISD Evaluation Plan

Introduction

ISD is a total quality process, which ensures that the training development process is both effective and efficient and that quality products are produced in each phase of ISD, with special emphasis on the final training system product—the graduate. The system must produce quality graduates who have the necessary skills, knowledge, and attitudes to perform in an operational environment. To ensure quality, evaluation must begin in the planning stages and continue throughout the life cycle of the training system. Updating the plan ensures that the most current and accurate information is used when evaluating the process and products of the training.

Purpose of the plan

The purpose of the ISD evaluation plan is to provide an organized, structured plan for evaluating the ISD process and products to ensure that a quality training system is designed, developed, and implemented.

Who is responsible?

Curriculum developers or their supervisors are responsible for developing the ISD evaluation plan for the training system. However, **everyone** in the training organization is responsible for **quality**.

When is a plan needed?

An ISD evaluation plan should be developed for each new training system developed and for any existing system that is revised significantly enough to warrant a new evaluation plan. This does not mean you cannot use an existing plan if it fits.

Format of the plan

The format of evaluation plans will be determined by the training organization developing the training. The content of the plan is flexible and will depend to a great degree on the complexity of the training project being developed and the strategy used to evaluate the system. In all cases, the plan should contain no more or less information than necessary to document the plan for evaluation. The plan should cover:

- Formative evaluation
- Summative evaluation
- Operational evaluation

The training organization can develop a separate evaluation plan for each phase of the evaluation process. The evaluation plan(s) can be included as part of the training development plan.

Evaluation plan job aid

A job aid for developing an evaluation plan is provided. The example job aid includes some of the information that should be described in an evaluation plan.

Example of Evaluation Plan Job Aid
<p>Purpose of the evaluation.</p> <p>Type of evaluation (e.g., summative, formative, training effectiveness, training capabilities, cost-effectiveness, test items, course or materials review).</p> <p>Method of evaluation (e.g., empirical, analytic, internal, external).</p> <p>Types of information to be collected (e.g., opinion, observation, performance).</p> <p>Procedures for collecting information as follows:</p> <ul style="list-style-type: none"> Criteria to select size and composition of target population sample. Criteria for site selection. Methods for collecting information about student/target population sample participants. Criteria for selection of instructors. Methods for collecting information about instructor participants. Methods for preparing facilities and equipment prior to conducting evaluation. Methods for preparing students and instructors to participate in the evaluation. Methods for test administration. Methods for collecting student reactions to the training during the presentation. Methods for observing presentation of training.

Evaluation plan job aid (Continued)**Example of Evaluation Plan Job Aid (Continued)**

Methods for collecting student and instructor comments at the conclusion of training.

Methods for recording data.

Methods for conducting interviews.

Methods for participants to provide additional data for an extended period following completion of the actual evaluation.

Methods for determining test validity and reliability.

Procedures for data analysis as follows:

Criteria for assessing performance.

Criteria and procedures for validating the evaluation.

Analytical treatment of data (e.g., statistical treatment).

Criteria and procedures for estimating criticality of deficiencies.

Procedures for reporting findings.

Procedures for reporting conclusions.

Procedures for reporting recommendations.

Data collection instruments (e.g., tests, checklists, structured interviews, questionnaires, and job performance indicators).

Schedule for data collection and performing the evaluation.

Resource requirements (e.g., personnel, materials, special equipment, travel funds, facilities).

Responsibility for testing and responsibility for conducting the evaluation.

Roles and responsibilities of all personnel involved (command, students, evaluators, graduates, and supervisors of graduates).

Identification of agencies and decision authorities who will receive the report.

Listing of proposed evaluation sites.

Scope of the evaluation (e.g., training objectives and critical standards).

**Updating the
evaluation plan**

To be an effective tool for managing the QI process, the evaluation plan must be continually updated with current and accurate information. The plan should be updated at the end of each phase of the ISD process or when significant changes warrant a revision to the plan. Information that may require updating in the evaluation plan includes items such as:

- Procedures to be used in evaluating the design process and products

- Design products to be evaluated, such as objectives and test items

- Standards to be used to evaluate the design process and products

- New or revised milestones

- Changes in the validation procedures

- Changes in the evaluation procedures

- Changes in the data to be collected during internal or external evaluations

- Changes in the procedures for evaluating the development process

- Changes in the methods of collecting external evaluation data

- Revisions to the evaluation schedule, such as:

 - When the design process and products will be evaluated

 - Quality of products to be evaluated

- Results of the design phase

- Rationale for changes made to the ISD evaluation plan

- Lessons learned during evaluation of the design process and products

**Tracing the quality
process**

Quality of the design process and the resulting products is essential to the training development process. Therefore, you should document evaluation of the design phase to the point that the quality process can be traced throughout the entire ISD process, including the design phase. However, document only what is needed. Never document more than you need.

Section F

Write Training Development Plan

Introduction

One of the keys to developing an effective and efficient training system is to have a good **training development plan**. In some training communities, the training development plan is also called an ISD management plan. The plan should be broad in scope and should focus on the various development activities of the organizations involved in the development effort.

Purpose

The purpose of the training development plan is to provide planning information and define the responsibilities for developing the training system.

Who is responsible?

Writing the training development plan is the responsibility of the curriculum developer. However, the need to develop a plan is determined by management.

When is a plan needed?

A training development plan is not required for each training development project. The scope and complexity of the project will determine the need for a development plan. Management should consider these two factors before making the decision to write a plan. For example, an item that would influence the need for a plan would be more than one site conducting the same training.

Format of the plan

The format of the plan is determined by the organization responsible for writing the plan. Its content and detail are determined by the scope of the ISD project. However, the format should be flexible to ensure that it meets the needs of each training development program and that it contains no more or less information than necessary to develop an effective and efficient training system.

Training development plan job aid

A job aid for writing a development plan is provided.

Training development plan job aid (Continued)**Example of Training Development Plan Outline Job Aid**

- I. Approval/Authority Statement
- II. Program Summary
 - A. Description – Scope of the project
 - B. Operational Concept – Operating location, environment
 - C. Maintenance Concept – Levels and locations of maintenance
 - D. Personnel Concept – Types, numbers, utilization
 - E. Training Support Issues – Significant and unique issues
 - 1. Schedules
 - 2. Costs
 - 3. Supportability
 - 4. Issues needing resolutions/decisions for implementation
- III. Instructional System Development Summary
 - A. Training Concept
 - 1. Summary of training system
 - 2. Training strategy
 - 3. Constraints/alternatives/tradeoffs
 - B. Target Population Description
 - 1. Entry tasks, skills, knowledge
 - 2. Selection procedures/constraints
 - 3. Target population issues to be resolved
 - C. Curriculum Development
 - 1. Description of steps and courseware formats
 - 2. Resource requirements–personnel, equipment
 - 3. Development milestones
 - 4. Curriculum issues needing resolution
 - D. Training Program Implementation
 - 1. Implementation milestones
 - 2. Location/time
 - 3. Resource requirements–personnel, funds, equipment, facilities
 - 4. Faculty composition and training requirement
 - 5. Curriculum administration and management
 - a. Types of courses, content, and duration
 - b. Distribution procedures
 - c. Media/training equipment required
 - d. Types of courseware
 - e. Testing procedures

Training development plan job aid (Continued)

Example of Training Development Plan Outline Job Aid (Continued)
--

- | |
|---|
| <ul style="list-style-type: none"> f. Student management procedures—records, scheduling |
| <ul style="list-style-type: none"> 6. Evaluation Plan <ul style="list-style-type: none"> a. ISD process and product evaluation milestones b. Process and product evaluation procedures c. Revision responsibilities and procedure e. Validation milestones f. Resource requirements—personnel, time g. Validation procedures h. Revision responsibilities and procedures i. Summative evaluation milestones j. Summative evaluation procedures k. Resource requirements—personnel, funds l. Revision responsibilities and procedures |
| <ul style="list-style-type: none"> E. Curriculum Development and Implementation Issues to Resolve <ul style="list-style-type: none"> 1. Airspace 2. Fuel 3. Flying hours 4. Personnel 5. Facilities 6. Equipment |
| <ul style="list-style-type: none"> IV. Training Planning Team <ul style="list-style-type: none"> A. Team Composition B. Responsibilities C. Approval Authority D. Coordination and Distribution requirements |

Updating the development plan

Include, as a part of the training development plan, the scheduled reviews and revisions to the plan. For the plan to be effective, it must be periodically updated to include information such as:

- Changes to the milestones
 - Addition or deletion of information
 - New or revised resource requirements
 - Changes in the constraints
-

Section G

Design Training Information Management System

Introduction

Management of training information is essential for effective and cost-efficient training systems. It includes updating records, scheduling students, tracking equipment and meeting budgets. Automated training information management systems enhance the training organization's ability to perform this essential task.

Purpose

The purpose of automated training information management systems is to increase the effectiveness and cost-efficiency of the training system while managing the system in real time. It can also provide instructors with the latest training/data materials available. For example, automated systems can be used by:

- Instructors to update student status
- Registrar to track student status
- Schedulers to schedule students and equipment
- Curriculum developers to update training materials
- Managers to manage resources
- Students to tell where they are in the program

Who is responsible?

Training information management system design normally falls on a project manager assigned the responsibility to oversee the procurement of the system. However, training organization management and curriculum developers carry the responsibility for ensuring that the training information is managed effectively and cost-efficiently for their training. In most cases, managers will not have an option as to whether an automated information management system is designed for use or not. This decision is normally based on availability of a management system. If a system does exist, it will likely be used by all involved in the training organization.

Design considerations

As a curriculum developer, you may have the opportunity to help design or redesign a training information management system. When you provide your input to project management, some of the issues to be considered are:

- What is the cost?
- What are the hardware capabilities?
- Are there any special environmental requirements for the hardware?
- What are the software capabilities?
- Is the system documentation adequate?
- Who are the system users?
- Are the hardware and software user-friendly?
- Does this system have proven reliability?
- Is the system maintainable?
- Will the system interconnect/interface to existing systems?
- Is the system software compatible with other software?
- Does the hardware have expansion capability?
- Can the software be upgraded or modified easily?
- What training information will the system be able to manage?
- What data is required for individuals to do their jobs?
- What are the sources of data and are they current?
- What data do all multiple users require?
- What data is unique to specific users?
- What are the required data formats?
- What system security is required?

Off-the-shelf systems

There are commercial "off-the-shelf" software (cots) programs that can be purchased that will accomplish many, if not all, of your training information management requirements. Purchase of these programs eliminates the need to design and develop an entire, single database system to manage the training information, thus saving considerable time and effort.

Chapter 4

ANALYSIS

Overview

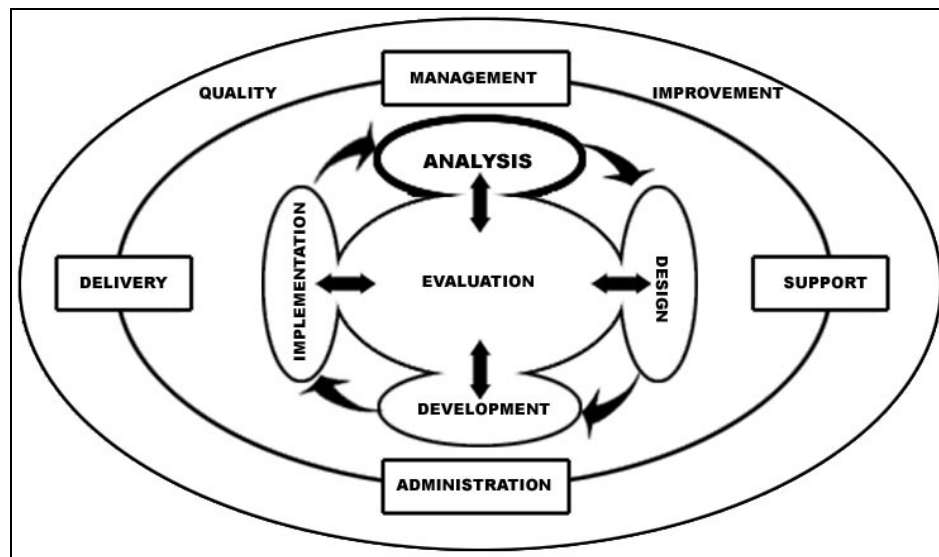
Introduction

Once initial ISD project planning has been done and adequate preparations have been made, it is time to enter the **analysis phase** of ISD. The nature and scope of each ISD project will be determined by the assessed training deficiency or training requirement. The assessed training need or requirement will also determine the level of analysis that will be required for the project.

Where are you in the process?

In order to visualize where you are in the training development process, an ISD model is depicted in Figure 9 with the analysis phase highlighted.

Figure 9 Analysis Phase



Objectives

The objectives of this chapter are to:

- Examine the various types of analyses that are done in the analysis phase.
 - Determine the requirement to update the ISD evaluation plan.
 - Execute the requirement to update the ISD management plan.
-

**Where to read
about it**

This chapter contains five sections.

Section	Title	Page
A	Conduct Task Analysis	66
B	Conduct Target Population Analysis	76
C	Analyze Resource Requirements / Constraints	78
D	Update ISD Evaluation Plan	83
E	Update Training Development Plan	86

**Additional
information**

For additional information on the various analyses, see:

AFMAN 36-2234, Instructional System Development, Analysis chapter.

Carlisle, K. E. (1986). *Analyzing Jobs and Tasks*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Wolfe, P., Wetzel, M., Harris, G., Mazour, T. and Riplinger, J. (1991). *Job Task Analysis: Guide to Good Practice*. Englewood Cliffs, New Jersey: Educational Technology Publications.

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Section A

Conduct Task Analysis

Introduction

The first stage of the analysis process is conducting **task analysis**. Since every job in the Air Force is made up of duties and each duty is made up of tasks, curriculum developers need to be experts in task analysis. Failure to do a good task analysis could result in ineffective training. A thorough task analysis will identify the tasks that need to be trained, under what conditions they should be taught, and the standard of performance that must be achieved.

What is task analysis?

In order to understand task analysis, a definition of a task is given first.

A **task** is an observable and measurable unit of work activity or operation, which forms a significant part of a job. It constitutes a logical and necessary step in performance, and has a logical beginning and end. It may also be defined as a series of actions leading to a terminal outcome, such as "starting engines on an F-15" or "performing an aborted take-off."

Now that a task has been defined, what is task analysis?

Task analysis is the process of breaking a task down to identify the:

- Component steps of a task
- Sequence of those steps
- Conditions under which the task will be performed such as using the simulator, part-task trainer, or materials required to perform the task
- Standard of performance that must be achieved

Purpose

During task analysis, each task is examined to determine performance requirements, such as which tasks must be performed, the conditions under which they are performed, and the performance standard that must be achieved. From this information evolves the task statement/list which is used to develop the course objectives.

Data collection

The first stage of task analysis is collecting the data for analysis. Several sources of data can be used in the task analysis process. Some of the sources are shown following.

Data Sources
Checklist AF Directives, Manuals, Handbooks Standard Operating Procedures MAJCOMs (user) System Program Office (SPO) Manufacturer's Manuals Contractor's Data SME

Data collection techniques

Numerous techniques can be used to collect data for task analysis. Examples of some of the most common techniques are shown below.

Data Collection Techniques
Review of job-related documents such as flight manuals, checklists Observation of actual job performance Interviews with SMEs Written questionnaire/survey Simulations of actual performance Analysis of similar systems

Ask the right question

When collecting data, focus on getting the necessary information for task analysis. This can be done by asking the right questions as you collect the data. Examples are given below.

To Identify. . .	Ask the Question. . .
Procedures, activities, steps	What does the person do first? Next?
Tools, materials	What is used to do the task?

**Ask the right question
(Continued)**

Weapon system,
computer

What is the task performed on?

Cues

How do they know when to do what?

Work environment or
conditions

Under what condition is the task performed?

Performance standards

What is the standard of acceptable performance?

Identifying tasks

Identifying the tasks that need to be trained for is a critical part of task analysis. When identifying tasks, you should:

Use all of the available data sources.

Assume that not all tasks may have been identified in the initial task analysis.

Task criteria

Understanding task criteria will help identify tasks during task analysis.

Task Criteria

A task is a group of related manual activities directed toward a goal.

A task has a definite beginning and end.

A task involves people interacting with equipment and media.

A task is observable.

A task is measurable.

A task is an independent part of a duty.

A task results in a meaningful product.

A task includes a mixture of decisions, perceptions, and/or physical activities required of an individual.

A task may be any size or degree of complexity.

**Guidelines
for task
statements**

Identifying tasks is a repeating process based on human activities that meet the above criteria. Each time it is repeated, the results of the process are made more complete and accurate. Continually repeating the process refines the task, which is continued until every task that makes up the duty is covered.

As the job tasks are identified, they are included in the listing in the form of a task statement. To ensure that quality task statements are developed, several guidelines and standards are provided.

Step	Description
1	Arrange major duty responsibilities in order of typical performance.
2	Indicate which tasks are performed in a fixed order and which ones have no particular order. Translate duty responsibilities (or human functions) into a list of task statements, composed of an action verb and an object.
3	Edit the list according to the standards provided below.

**Standards for task
statements**

Use the following standards when developing task statements.

Clarity

Use wording that is easily understood.

Be precise so it means the same thing to each individual.

Write separate, specific statements for each task. Avoid combining vague items of skill, knowledge, or responsibility.

Completeness

Use abbreviations only after spelling out the term.

To complete a form, include both form and title number, unless all that is needed is the general type form.

Standards for task statements
(Continued)

Conciseness

Be brief.

Begin with a present-tense action word (subject "I" or "you" is understood).

Indicate an object of the action to be performed.

When there are several different techniques or methods of doing a task, adding condition phrases to the task statement may be necessary.

Use terminology that is currently used on the job, such as "Perform an ASLAR departure."

Relevance

Do not state a person's qualifications.

Do not include items on receiving instruction, unless actual work is performed. The exception is commands from lead A/C, radio calls, or others.

Sample task statements

The following is a sample of satisfactory task statements.

Function or Duty	Sample Task Statements
Perform Air Refueling Activities	Given an F15, a tanker and the checklist, perform radio-silent air-to-air refueling.
Perform Aircraft Recovery Activities	Given an F16C and the Dash One checklist, perform single ship recovery.
Prepare for Mission	Given all mission relevant information, perform basic flight premission planning IAW the Dash One

Identifying subtasks

After the tasks have been identified, it is time to identify the subtasks. Subtasks are work activities that, when combined, make up a task. It should be noted that not all tasks are made up of subtasks. There are several reasons for identifying subtasks:

**Identifying
subtasks
(Continued)**

For some task statements to be useful in training development, the curriculum developers must identify subtasks so the steps involved in performing tasks are known. Complex tasks can be analyzed more easily if they are broken into subtasks.

Breaking a task into subtasks often helps sequence the training.

**Guidelines
for identifying
subtasks**

There are two basic guidelines for identifying subtasks:

Examine each task statement to see if it contains more than one group of activities that must be performed sequentially or independently.

Review the complete list of subtasks for each task, to ensure that no subtasks overlap and that together they account for all performance required.

**Example of
subtask**

An example of subtasks that make up a task is given below.

Example of Subtasks

Job – Fly the F16 Block 42 aircraft.
Duty – Perform a LANTIRN air-to-surface mission.
Task – Perform premission planning.

Subtasks

Determine the mission data.
Determine pretakeoff data.
Load the DTC.

Sequentially and independently performed subtasks

When identifying subtasks, be aware that some subtasks must be performed sequentially while others can be performed independently. Examples are provided below.

Sequentially Performed Subtasks	Independently Performed Subtasks
Task – Takeoff and climb	Task – Detect and react to aircraft malfunctions
Subtasks Accomplish single ship takeoff. Execute a climb and VFR departure. Execute a climb and instrument departure if in IFR conditions. Level aircraft at assigned altitude and accomplish cruise check.	Subtasks Abort takeoff. Perform emergency engine shutdown. Perform emergency egress.

Validate task information

Once the lists of tasks and subtasks have been analyzed, the results should be verified. Several techniques can be used for verifying the lists, as shown in the examples below.

Function	Technique
Verifying assembled task lists for an existing job	Questionnaires SME interviews Task observations of performance expert
Deriving a new task list for a new job	Interviews Questionnaires Simulations SME assumptions

Selecting tasks to be trained

After the task and subtask lists are verified, the tasks to be trained are selected. When selecting the tasks to be trained, several things should be considered. For example, when reviewing the list, consider:

- Can most job incumbents perform the task without training?
- How often is the task trained on the job?
- Will job degradation occur if the task is not trained?
- Is the task critical to job or mission performance?
- Is it economical to train the task?
- Is there enough time to train the task adequately?
- If people are trained to do another task, will they be able to transfer what they have learned to perform this task without additional training?
- Will geographical, procedural, and environmental conditions make it unreasonable to train everyone to perform the task?
- Is the number of persons required to perform the task sufficient? What is the percentage of those performing the task?
- Is the task difficult to learn? After some experience?
- If individuals are trained to perform the task, will they remember how to perform the task when they get to the job?

Documenting the tasks

A variety of formats can be used to document the task analysis. One simple way to document task analysis is to use a Task Analysis Worksheet similar to the one provided next. Regardless of the format that you use, the key is to document only the identity, training, and support information. The goal is to ensure the quality of the analysis process and have adequate information to develop objectives in the next phase of ISD.

Task

Check the data collection techniques used:

- ☐ review of technical documents (list sources)
- ☐ direct observation of job performance (list sources)
- ☐ interview with subject matter experts (list sources)
- ☐ group meetings (list sources)
- ☐ survey questionnaire (list sources)

**Documenting
the tasks
(Continued)**

Check the data collected:

- ☐ procedures, activities, steps (see attachment #)
- ☐ tools, materials (see attachment #)
- ☐ equipment, weapon systems (see attachment #)
- ☐ cues (see attachment #)
- ☐ work environment/time constraints (see attachment #)
- ☐ performance standards (see attachment #)

If an item is not checked, explain why the data is not necessary.

**Example task
analysis job aid**

A task analysis job aid can be in any form that meets your need. The main consideration is that you collect sufficient data in order to do a task analysis. Following is an example of a task analysis worksheet that can be modified to meet your specific need.

Job Aid – Task Analysis Worksheet

Job

Duty

Task

Task Attribute

Description

Output (desired behavior)

Standard of Performance (time, rate, percent)

Equipment (equipment required to perform task)

Tools (tools required to perform task)

Safety (safety considerations when performing task)

Cue (what prompts performance)

Conditions (weather, 2v Many, etc.)

Location (where the task is performed—aircraft, OFT, etc?)

References (documentation used in task performance such as checklist, Dash One)

Human Interface (will others be involved in performing the task?)

**Example task
analysis job aid
(Continued)**

Also, the task analysis worksheet should identify each subtask and its attributes that make up a task. An example is shown below.

Subtask Attribute	Description
-------------------	-------------

Skill (skill that is necessary to perform the task)	
--	--

Knowledge (facts, concepts, principles that are required to perform the task)	
--	--

Attitude (interest, motivation necessary to perform the task)	
--	--

Section B

Conduct Target Population Analysis

Introduction

In order to design effective and efficient training, the curriculum developer should know for whom the training is being designed. It is essential that an accurate description of the target population be defined so the proper decisions can be made about course design and the resources required to support the design. This analysis further defines the resource decisions made during the initial planning stages for the ISD project.

Definition

A target population analysis is the analysis of the persons for whom the training is designed in order to determine the range of their aptitudes, experiences, and skills and knowledge about the subject matter.

Who is responsible?

Curriculum developers are responsible for conducting the target population analysis, when necessary.

When should it be done?

The target population analysis should be conducted prior to starting to design the training system.

Why should it be done?

Target population analysis should be conducted to gather information so proper decisions can be made about:

- Training requirements
- Course content
- Course length
- Method and type of media to be used
- Equipment and facilities
- Training strategies to be employed

What should be the results?

The target population analysis should identify the probable range of aptitudes, experience, skills and knowledge about the subject matter that individuals in the group possess.

How to conduct an analysis

One of the simplest ways to conduct the analysis is to conduct interviews and research all available information about the target population. The goal of the interviews and research is to find answers to questions that address:

- Job/position level of the students
- Previous background of the students
- Courses they may have completed relating to the job
- Job experience relating to the training
- Skills and knowledge already possessed by the students
- Any other related qualifications

Section C

Analyze Resource Requirements / Constraints

Introduction

Resources are the **critical** factor in every training system. During the initial planning stages for the ISD project, one of the first concerns is identifying resources required for the training system. This same concern for resources continues into the analysis phase of training development as well. It is unlikely in this phase that all of the needed resources can be identified. However, identification of long-lead-time resources, such as training equipment and facilities, should be identified in order to allow sufficient time to secure the resource. If you are facing a resource constraint, you will need time to work out alternatives.

What are resources?

Training system resources can be categorized into five major areas:

- Equipment, such as aircraft, simulators, part-task trainers
- Facilities, such as classrooms, ranges, air space
- Funds for equipment, supplies
- Personnel, such as instructors, curriculum developers, SMEs (loadmasters, pilots, flight engineers, etc.)
- Time, such as flying hours, simulator time, training development time

Why analyze resources?

Resources are analyzed in order to identify:

- Type of resources required, such as personnel and equipment
- Quantity of resources required, such as number of instructors, classrooms, trainers
- When the resources are needed in order to meet the training delivery date
- Total cost of resources

Who is responsible?

Conducting the resource analysis is the responsibility of the curriculum developer. However, securing the needed resources is the responsibility of organizational management, with the assistance of the organization that provides the resources.

**Before you analyze
the resource
requirements**

Before beginning to analyze the resources required for the training system, consider several things that may help to conduct a better analysis.

Equipment

Most major system-specific or unique equipment items must be identified as early as possible in the ISD process, since they must normally undergo a cycle of design, development, production and testing, prior to delivery.

Failure to identify training and support equipment requirements early may result in delay of training implementation.

Equipment should not be placed on order or procured until the objectives have been tentatively set for the course, ensuring that there is a valid requirement for the equipment.

When selecting equipment for the training system, consider these factors:

- Suitability or appropriateness

- Usability

- Reliability

- Maintainability

- Cost

Facilities

Identify facility requirements as early as possible since the time required to get funds is normally long; also, the time to get approval and build new facilities or modify existing facilities can be considerable.

Funding

Budgets must often be prepared or revised prior to getting the necessary funds appropriated to:

- Procure equipment.

- Buy fuel.

- Construct or modify facilities.

- Pay personnel cost.

Budgets are normally submitted and approved long before money is actually spent; thus, organizational managers and curriculum developers must determine, as precisely as possible, what resources will be required for the training system.

**Before you analyze
the resource
requirements
(Continued)**

Personnel

Lead- time for additional personnel such as curriculum developers and instructors can be lengthy, since it involves the budget and personnel authorizations.

When requesting personnel, such as curriculum developers and instructors, allow sufficient time to properly train them for their assigned duties.

Identify additional support personnel, such as typists or hardware fabricators, if applicable.

Time

If possible, allow sufficient lead time to:

Obtain the necessary equipment.

Build new or modify existing facilities.

Get personnel authorizations approved and personnel properly trained.

Secure the required funding.

Design, develop, and provide an effective and efficient training system.

Determine the flying hours that will be needed in the aircraft and simulator.

**Analyzing resource
requirements**

In the analysis phase, all of the resources will need to be analyzed in order to identify and estimate the resource requirements for the training system. To help analyze resources, a simple job aid can be developed using questions. An example of a job aid is provided below.

Resource	Sample Questions
Equipment	<p>What types of equipment will be required (training, support)?</p> <p>What equipment will be required (simulators, part-task trainers, computers)?</p> <p>Where and how will the equipment be obtained?</p> <p>How will the equipment be used in the course?</p> <p>What quantities will be required?</p> <p>What is the life cycle of the equipment?</p> <p>If faced with an equipment constraint, can alternative equipment be used? If so, what equipment?</p>

**Analyzing resource requirements
(Continued)**

Resource	Sample Questions
Facilities	What types of facilities will be required (classrooms, ramp areas)? How much space will be required? Are facilities available on the base? If facilities exist on the base, will they require modifications? Does the facility meet environmental requirements, if applicable?
Funds	What are the initial costs of equipment, facilities and personnel? Will the training development be contracted for? What are the recurring costs associated with operating the training system? Are there TDY costs associated with training?
Personnel	How many curriculum developers will be required to meet the training delivery date? Will instructors be needed? If so, how many? Will the training system require additional overhead personnel?
Time	How many flying hours are needed? How much simulator time is needed? What is the training delivery date? How much time will be required to develop the training? Is there any equipment lead-time requirements? If so, how much? If new or modified facilities are required, how long will it take? What is the estimated course length?

Finding answers to questions such as these will help analyze resource requirements for the training system.

What about resource constraints?

Everyone in the training organization should conserve resources. Since resources are usually in short supply, you may not be able to obtain resources that are required for the training system. Regardless of the situation, the constraint needs to be resolved or an alternative solution selected. The following table provides several examples of actions/alternatives that might be considered when faced with a resource constraint.

**What about
resource
constraints?
(Continued)**

Constraint	Action/Alternative
Equipment	Borrow equipment belonging to other organizations or MAJCOMs. Share equipment with other organizations or MAJCOMs. Use prototype equipment. Use a trainer or simulator rather than the actual equipment. Increase the number of students using a single piece of equipment. Operate on more than one shift. Increase class intervals.
Facilities	Use temporary facilities. Use other organization or MAJCOM facilities. Operate on more than one shift. Decrease group size. Increase class intervals.
Funding	Reduce resource requirements. Seek alternative funding sources.
Personnel	Contract out if funding available. Reduce the number of graduates produced. Borrow curriculum developers or instructors from other organization or MAJCOMs. Reduce the multiple instructor requirements.
Time	Borrow additional personnel, such as instructors, from other organizations or MAJCOMs. Reduce course length. Select alternative methods or media.

**Updating resource
requirements**

In the initial planning stages, some of the required resources were identified. However, during the initial planning it is impossible to know all the resources that will be needed. This is why resources should be analyzed during the analysis phase. If the analysis is done properly in this phase, a good estimate of the types and quantities of resources can be identified. But this is not the end of resource analysis. As training development progresses through the design and development phases of ISD, resource requirements will continually need to be redefined and fine-tuned. Updating the resource requirements will help to ensure that adequate resources are available to support the training system.

Section D

Update ISD Evaluation Plan

Introduction

During the initial planning for the ISD project, an **ISD evaluation plan** was developed. The purpose of the plan was to ensure the **quality** of the process and products of each phase of ISD. Thus, the evaluation plan becomes the "metric" or standard for continuous evaluation of the training system. To ensure that the plan remains an effective evaluation tool throughout the "life cycle" of the project, it will probably need to be periodically updated.

Caution – Document **only** as needed.
Do not document just to fill a case file.

Why update the evaluation plan?

The nature and scope of every ISD project is different; thus, every ISD evaluation plan will be different. These differences will make it difficult, if not impossible, to develop an ISD evaluation plan that will be "on target" and effective throughout the life cycle of the training system. Therefore, as the analysis phase is completed, it is likely the evaluation plan will need to be updated to reflect the results of the evaluation efforts during the analysis phase. Updating the plan will ensure that it is current and accurate and ready to be used to evaluate the process and the products of the design phase.

Who is responsible?

Curriculum developers are responsible for ensuring that the evaluation plan is updated at the end of the analysis phase, as applicable. However, **everyone** involved in training development is responsible for the quality of the ISD process and products.

What should be updated?

It is essential that the ISD evaluation plan be periodically updated if it is to be an effective tool in evaluating the ISD process and products. Updating the ISD evaluation plan may include, but not be limited to:

Revisions to the evaluation plan for the analysis phase, including:

Analysis products to be evaluated, task list, and objective hierarchy

**What should be updated?
(Continued)**

Quality standards to be used to evaluate analysis phase products
Procedures to be used in evaluating the analysis process and products

Revisions to the evaluation schedule, such as:
When the process and products will be evaluated
Quantity of products to be evaluated

Documenting the analysis phase evaluation results
Rationale for changes made to the ISD evaluation plan
Lessons learned in evaluating the analysis process and products

Tracing the quality process

Quality of the analysis process and the resulting products is very important to the training development process. Therefore, the curriculum developer should document the evaluation that was conducted during the analysis phase to ensure that the quality process can be traced throughout the entire ISD process, including the analysis phase.

Section E

Update Training Development Plan

Introduction

Even before the training development process entered the analysis phase, the curriculum developer wrote a **training development plan** to serve as a "roadmap" for managing the training development process. It is essential that a plan be developed so that you will have a good idea of where you want to go and how you intend to get there. Because it is essential to write the training development plan in the initial stages of project planning, it will probably need to be periodically updated to ensure that it remains an effective management and development tool.

Why update development plans?

The training development plan should be updated at the end of the analysis phase, as applicable, to reflect any changes in the training development process resulting from the analysis phase. If the training development plan is not updated, it will become ineffective as a management and training development tool.

Who is responsible?

Curriculum developers are responsible for updating the training development plan. The developer should keep the plan updated with the most current and accurate information resulting from the analysis phase.

What should you update?

After the analysis phase has been completed, the training development plan should be updated with new or revised information resulting from the analysis phase, such as:

- Changes to the overall training development strategy
- New or revised milestones
- Refinements to project definition
- Changes in resource constraints
- Revisions to resource requirements
- Addition or deletion of tasking

Items or areas that will consistently change, e.g., milestones, can be placed in an appendix. Changes would then be limited to the back part of your plan.

Chapter 5

DESIGN

Overview

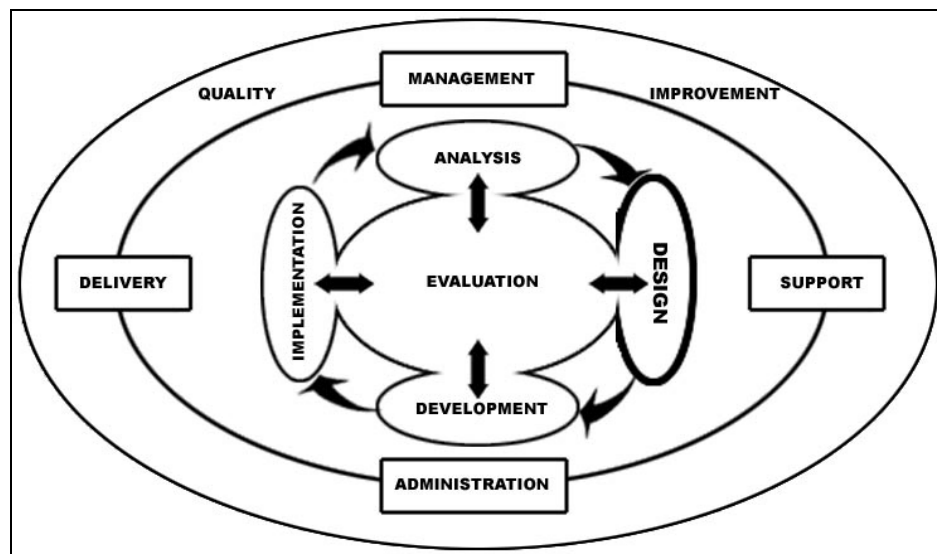
Introduction

At this point, the analysis phase has been completed and you are ready to enter the **design phase** of ISD. During this phase, types of learning and training methods will be reviewed before the framework for the training will be built by developing objectives and designing the training necessary to achieve the objectives. The design selected will play a key role in determining the effectiveness and efficiency of the training that will be developed. Also in this phase, as well as throughout the entire ISD process, quality improvements in the process and products will be a major concern. Much work has been contributed toward the cognitive approaches to instruction. Curriculum designers are encouraged to review the research in this area (see AFHR PR 87-34).

Where are you in the process?

An ISD model, with the design phase highlighted, is depicted in Figure 10 to help visualize the ISD process.

Figure 10 Design Phase



Objectives

The objectives of this chapter are to:

Review types of learning and training methods
Examine the elements of training design.
Determine the process of designing training.
Create the design phase planning activities.
Prepare the quality improvement functions in the design phase.

Where to read about it

This chapter contains seven sections.

Section	Title	Page
A	Review Types of Learning	88
B	Select Training Methods	94
C	Develop Objectives	98
D	Develop Tests	113
E	Review Existing Materials	128
F	Design Training	131
G	Update Training Development Plan	144

Section A

Review Types of Learning

Introduction

In this section, learning is addressed in terms of the individual types of learning and the integration of human activities. Categories of learning types establish a framework for how learning takes place. In real life, these types of learning are integrated. This integration is discussed in terms of schemas, enterprise theory and metaskills.

Types of learning

Learning theorists have categorized human activity into types of learned behavior. Gagné's (1985) categories of learning types are the most inclusive. They include intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. Gagné suggests that each type of learning requires different internal conditions for processing to occur. Internal conditions may be cued or prompted by external conditions present in the learning environment. The following five areas will be covered:

Title	Page
Intellectual skills	88
Verbal information	89
Cognitive strategies	89
Motor skills	90
Attitudes and motivation	90

Intellectual skills

Intellectual skills are the foundation for all higher learning. They consist of discrimination, concepts and rule using. Cognitive strategies are often called a higher-order type of intellectual skill.

For the purpose of instructional design intellectual skills needs to be subdivided. Concepts (kinds-of) are different from principles (what-happens) which are different from procedures (how-to).

Intellectual skills are hierarchical in nature. In order to learn a higher-order skill, the learner should possess the prerequisites. To learn a rule or principle, the learner should understand the component concepts and the relationships among the concepts.

**Intellectual skills
(Continued)**

Discriminations. Discriminations are skills related to seeing differences between stimuli. Most adult problems in discrimination come from physical disabilities like color blindness, hearing loss, or some injury that affects sensory perception.

Concrete Concepts. Concrete concepts are skills related to categorizing physical objects into one or more classes based on their physical attributes. Identifying resistors from among other electrical components is an example of concrete concept learning.

Defined Concepts. Defined concepts are skills related to classifying symbolic objects into one or more classes based on a definition. The definition is actually a rule for classification. For example, classifying a verbal statement from an officer as a command is an example of a learned defined concept.

Rule Learning. Rule learning skills relate to applying principles or procedures to solve problems. Problem solving is the ability to recall relevant rules and use them to solve a novel problem. The product of problem solving is not only a solution to the problem, but also learning a new rule or procedure to be used if a similar situation should arise in the future.

Verbal information

Verbal information is the learning of names and labels that can be verbalized. It is also called declarative knowledge. Verbal information learning requires some basic language skills. In addition, verbal information is more readily retained when it is learned within a larger context of meaningful information.

**Cognitive
strategies**

The basic premise of an information-processing model is that individuals mentally process their environment. This process consists of a number of stages in which the stimuli become information, which is given meaning by previous knowledge and current expectations. Cognitive strategies are employed to maintain the knowledge in short-term memory and translate it to a structure that enters long-term memory as a type of knowledge in the form of propositions, productions or schemas.

**Cognitive strategies
(Continued)**

Cognitive strategies are thought of as executive control mechanisms for learning. Monitoring the use of strategies is "metacognition." Cognitive strategies used in metacognition are called metacognitive strategies.

There are different types of cognitive strategies such as clustering items into similar groups to reduce memory load, reading strategies to increase comprehension, and others. Good learners have a variety of strategies they can use to process new information.

Motor skills

Motor skills are learned behaviors that involve the smooth coordinated use of muscles. Motor skills most often involve a sequence of activities that may be described verbally as an "executive subroutine." This verbal information is learned to provide guidance for learning the execution of the motor skill. When the learner has acquired the motor skill, the verbal routine is no longer needed and the skill is performed in a smooth and continuous manner.

Motor skills may be learned by modeling, as when a coach shows a student how to swing a golf club.

Motor skills require practice and kinesthetic (natural) feedback. Verbal feedback from an observer also helps the learner make corrections in performance. Much of the instruction is aimed at getting the student to recognize the feel of the motor performance when it is executed correctly.

Attitudes and motivation

The acquiring of particular attitudes may require the prior learning of intellectual skills or particular sets of information. For example, if a positive attitude toward safety is to be acquired, the learner should have (1) intellectual skills (concepts and procedures) associated with safety, and (2) a variety of verbal information about the advantages of following safety procedures or the consequences of not following them.

Attitudes have mutually supportive relationships. An individual generally tries to maintain consistency with regard to choice

**Attitudes and
motivation
(Continued)**

behaviors. However, attitudes are based on perceptions of reality.

These perceptions are colored by misinformation or critical experiences.

Attitudes are learned by observing others and viewing the consequences of their behavior. This type of learning (vicarious) is a distinct principle of social learning. External conditions for learning attitudes include a human model.

Experiences play a major role in the formulation of attitudes.

Motivation plays a significant role in learning. Keller (1987) has developed a general model integrating the various sources of motivation for learning. He calls it the ARCS model, an acronym for the four sets of conditions that should be met to have a motivated learner:

A for attention.

Attention involves grabbing the learner's interest at the beginning of instruction and maintaining that interest throughout the lesson and course.

R for relevance.

Relevance is the personal significance and value to the learner of mastering the learning objectives.

C for confidence.

Confidence relates to the learner's expectancy of success.

S for satisfaction.

Satisfaction comes from achieving performance goals.

**Integration of
human activities**

In real life, the types of learning are integrated. This integration is discussed in terms of schemas, enterprise theory and metaskills

Schemas

Intellectual skills should be integrated into existing knowledge to be remembered and recalled. They are thought to be stored as schemas and as part of pre-positional networks. A schema is an organization of memory elements (propositions, images, and attitudes) representing a large set of meaningful information pertaining to a general concept. The concept may be of an object, such as a jet fighter, weapon, or officer. Or it may be an event, such as a preflight check or preventive maintenance procedure. Regardless of type, schemas contain information on certain well-understood features of the object or event. The learner fills in these features, called slots, when encountering new information that relates to the schema. Schemas are acquired through experience and may be the greatest benefit of apprenticeships. Recent theory proposes that intellectual skills are "situated." That means their utility is in a large part a function of how they are learned. In order that they do not become "inert knowledge," they should be learned and practiced within a broader context.

Enterprise theory

Gagné and Merrill (1990) proposed a method to identify learning goals that requires an integration of multiple objectives. They proposed that such an integration of multiple objectives be conceived in terms of the pursuit of a comprehensive purpose in which the learner is engaged, called **enterprise**. An enterprise is a purposeful, planned activity that may depend for its execution on some combination of verbal information, intellectual skills, and cognitive strategies, all related by their involvement in the common goal. A task for the instructional developer is to identify the goal of a targeted enterprise along with its component skills, knowledge, and attitudes, and then to design instruction that enables the student to acquire the capability of achieving this integrated outcome.

Metaskills

The metaskill concept (Spears, 1983) refers to the complex skills of adapting, monitoring, and correcting the use of individual skills in complex performances that integrate cognitive, perceptual, and motor processes. Proficiency in metaskills depends on the number of individual skills practiced. Plateaus in performance are related to the intervals required for students to put together new sets of metaskills.

**Metaskills
(Continued)**

Processes involved include:

Gaining organic knowledge of the effects of actions on overall goals.

Organizing knowledge hierarchically to include cause-effect rules.

Developing monitoring procedures that incorporate outcome expectancies.

**Internal events of
information
processing**

Events of instruction are a set of communications embedded in instructional activities. They serve the function of activating internal events of information processing. The learning process is shown in the following table.

Learning Process	Learning Phase
Expectancy	Motivation
Perception	Apprehending
Working Storage	Acquisition
Encoding	Processing
Storage	Retention
Retrieval	Recall
Validation of Understanding	Feedback
Transfer	Generalization
Valuing	Personalizing

Section B

Select Training Methods

Introduction

Selecting the **training method** is an important activity in the training design process. The method selected will impact effectiveness and efficiency of the training system.

Definition

A training method is the process used to deliver the instructional content and to provide guidance for students to retain the skills and knowledge imparted. Examples include lecture, demonstration, and self-study.

Training methods

There are many training methods that can be selected, as described in the following material.

Selection considerations

There are several factors to be considered when selecting training methods for the training system. These factors can be categorized into three major areas: constraints, cost-efficiency, and training considerations.

Constraints

Constraints include:

Geographical spread of target population—If the target population is widely spread it may not be feasible to bring students to a central location for training. If this is the case, classroom training may not be the appropriate training method. Consider other training methods such as OJT, self-study.

Student availability—If there is an insufficient flow of students due to lack of resource constraints, it is unlikely that classroom training will be appropriate. OJT or self-study may be a better method. Also, consider using CBT if there are large numbers of students to be trained over a long period of time. Instructors/trainers availability—If instructors/trainers are not available, consider using other training methods such as self-study.

Facilities and equipment availability—If there is a lack of adequate facilities and equipment to handle student flow, consider OJT or self-study.

**Constraints
(Continued)**

Development time—Training methods such as CBT require considerable development time. If there is limited time or only a few students to be trained, consider other training methods such as self-study or OJT.

Safety—When performance of the objective could cause loss of life, bodily harm, or loss of equipment, consider other methods such as CBT.

Non-availability of ICW development specialist—If neither the personnel nor the funds to acquire them are available, you may have to consider other training methods, such as lecture combined with video.

The following form includes points for different training methods.

TRAINING METHODS	
Presentation methods	<p>Presentation methods include:</p> <p>Lecture – A formal or semiformal oral presentation of information by a single individual; facts, concepts, problems, relationships, rules or principles presented orally either directly (as by classroom instructor) or indirectly (as by video).</p> <p>Demonstration – Presentation or portrayal of a sequence of events to show a procedure, technique, or operation; frequently combines an oral explanation with the operation or handling of systems equipment or material. May be presented directly (as by a classroom instructor) or indirectly (as by video).</p> <p>Exhibit – A visual or print display used to present information; for example, actual equipment, models, mockups, graphic materials, displays, chalkboard, or projected images.</p> <p>Indirect Discourse – Verbal interaction among two or more individuals which is heard by the student; may be a dramatization, such as role playing, or a dialogue between panel members, or a teaching interview (a question and answer session between instructor and visiting "expert").</p> <p>Assigned Reading – Printed verbal materials such as books, periodicals, manuals, or handouts. Reading may be course-assigned or self-assigned.</p> <p>Teaching Interview – Question and answer session between the instructor and visiting "expert" following a highly structured plan.</p>

TRAINING METHODS (Continued)	
Student verbal instruction methods	<p>Student verbal instruction methods include:</p> <p>Questioning – An instructor and/or courseware controlled interactive process used to emphasize a point, stimulate thinking, keep students alert, check understanding, or review material. Questioning may be direct, as by a classroom instructor, or may be designed into a film or television presentation.</p> <p>Programmed Questioning – An instructor and/or courseware controlled interactive process used to systematically demand a sequence of appropriate student responses; may be used directly (as by an instructor in a classroom) or indirectly (as by programmed booklets or computers).</p> <p>Student Query – The provision by which students are given the opportunity to search for information, as by questioning a classroom instructor, tutor, coach, or an appropriately programmed computer.</p> <p>Seminar – A peer-controlled group interactive process in which task- or objective-related information and experience are evoked from the students. Questions may be used to evoke student contributions, but the seminar is distinguished from questioning.</p> <p>Discussion – An instructor-controlled interactive process of sharing information and experiences related to achieving a training objective.</p>
Knowledge application methods	<p>Knowledge application methods include:</p> <p>Performance – Student interactions with things, data, or persons, as is necessary to attain training objectives; includes all forms of simulation (for example, games and interaction with hardware simulators) and interaction with actual equipment or job materials (for example, forms).</p> <p>Performance may be supervised by classroom instructor, tutor, coach, or peer to provide needed feedback.</p> <p>Case Study – A carefully designed description of a problem situation, written specifically to provoke systematic analysis and discussion.</p>

Cost-efficiency

Cost-efficiency points include:

Trained Personnel Requirements (TPR) – Expensive delivery systems such as CBT may be justified if the TPR is large and the training is required over a long period of time. A training method you would not likely use to train a large TPR is OJT.

Content stability – If training content requires frequent updates, methods such as CBT are less suitable than classroom, OJT, or self-study.

Amount of practice required – If there is a lot of practice required you may want to consider ICW as a training method, since practice time is only limited by the availability of the student and the equipment. In the classroom or OJT, however, an instructor or trainer is required, which makes practice time costly.

Training considerations

Training considerations include:

Task criticality – If task performance is critical, consider formal classroom training or OJT. Self-study would be a questionable training method for training critical tasks.

Learning difficulty – A task that is difficult to learn should be taught using the classroom or OJT method, or a part-task trainer may be appropriate.

Training fidelity – If the training fidelity requirement is high, consider selecting a method that uses the actual equipment to teach the process or procedures.

Interaction level. If the learning process requires a great deal of interaction, OJT is probably the best, since it is highly interactive. If the group size is small, classroom training can provide moderate interaction. You may not want to use self-study if the learning process requires high interactivity.

Section C

Develop Objectives

Introduction

One of the products of the analysis phase is a listing of tasks requiring training. In the design phase of ISD, this task list will be used to develop the objectives for the course. Objectives serve as the "foundation" of the course on which all training is built. When developing the objectives, remember that objectives should be stated in terms of what the students must be able to do at the end of training.

Definition

An objective is a precise statement of the learned capability—skills, knowledge or attitudes (SKA)—a student is expected to be able to demonstrate, the condition under which the SKA is to be exhibited, and the minimum standard of acceptable performance.

Purpose

Objectives serve several purposes. Examples are given below.

For Curriculum Developers	For Students
Serve as the foundation for building training. Provide a basis for test development. Allow for selection of the most appropriate training strategies.	Direct attention to the important content. Communicate standard of performance expected following the training. Serve as a self-check for progress.

Other terms for objectives

Objectives have been given many names, such as:

- Performance objectives
- Behavioral objectives
- Instructional objectives
- Training objectives
- Criterion-referenced objectives (CROs)

Parts of an objective

An objective has three parts:

Condition
Learned Capability
Standard

Each part of the objective is discussed later in this section under "Characteristics of Objectives."

Levels of objectives

Many terms have been used to describe the levels of objectives. The following terms are often used to distinguish the levels.

Terminal
Primary
Enabling
Secondary
Supporting
Subordinate

This handbook will only refer to the different levels in order to show the hierarchical relationship of objectives.

Examples of objectives

The following are some examples of objectives.

Given a diagram of the Primary Alerting System (PAS) panel, and a list of functions and incomplete statements relating to the PAS panel operation, the trainee will perform the following to 85% accuracy, correctable to 100%.

Recall the function of each control and indication by **matching** the proper function to the control or indicator in the diagram.

Recall each PAS operation by completing each statement.

Given a diagram of the Flight Director system display (ADI and HSI), identify the parts as they are labeled in Section I of the Dash One with 85% accuracy correctable to 100%.

**Where to read
about it**

This section covers four topics.

Topic	Page
Characteristics of Objectives	101
Guidelines for Developing Objectives	106
Hierarchy of Objectives	107
Prioritizing, Clustering, and Sequencing Objectives	110

**Additional
information**

For additional information on objectives, see:

AFMAN 36-2234, Instructional System Development, Design chapter.
Davies, I. K. (1976). *Objectives in Curriculum Design*. London: McGraw Hill Co.
Kibler, R. J. (1981). *Objectives for Instruction*. Boston: Allyn and Bacon.
Mager, R. F. (1962). *Preparing Instructional Objectives* (2nd Ed.). Belmont, California: Fearon Publishers.

Characteristics of Objectives

Introduction

Before starting to develop objectives, curriculum developers should be able to recognize each part of an objective, given examples. Familiarity with the parts of an objective will ensure that better objectives are developed, which produces better training.

What is contained in this topic

This topic is divided into three parts.

Parts of an Objective	Page
Condition	102
Learned Capability	103
Standard	104

Condition

Introduction

Curriculum developers should thoroughly understand the **condition** part of an objective in order to develop more effective objectives. When developing objectives, use the actual conditions under which the job will be performed, if possible.

Definition

A condition identifies the situation under which a student is expected to demonstrate a behavior as a result of the training. A properly prepared objective clearly states the limits and/or conditions of student performance. A condition may describe:

- If the student can use the checklist
 - If the student is allowed to use the flight manual
 - What equipment students are allowed to use
 - If students can use notes they have taken during the training
-

Examples

The following are some examples of variable conditions, which can vary from situation to situation and not affect the type of learning involved.

- "Given an AN/TPQ-43 radar set, ..."
 - "Using a diagram of the Flight Director system, ..."
 - "Given incomplete statements on Offensive Radar System operation, ..."
 - "Without reference, ..."
 - "Under conditions of total darkness, ..."
 - "Given a checklist, and the Dash One, ..."
-

Learned Capability

Introduction

The capability part of the objective states what the students will do to demonstrate that they have learned a specific skill, knowledge or attitude. The capability must be written in measurable, observable terms so that student performance can be objectively evaluated.

Description

A capability is defined as an observable, measurable performance that the student should demonstrate.

Action verbs

When writing the capability part of an objective, use action verbs to reduce ambiguity. Action verbs are observable and measurable, while ambiguous ones are not. The following table provides some examples.

Action Verbs	Ambiguous Verbs
Perform	Understand
Fly	Know
List	Learn

Examples

Several examples of learned capability statements are:

"... locate Electrical Multiplex controls ..."
"... recall the function of each control ..."
"... perform a built-in-test on HUD ..."
"... fly a low-approach ..."

Standard

Introduction

The final part of the objective to be discussed is the standard. The student's performance will result in an output; the quantity or quality of which is the standard of performance.

Definition

A standard defines the criteria for acceptable performance by the student. It is stated in terms of completeness, accuracy requirements, time constraints, performance rates, or qualitative requirements. It identifies the proficiency the students must achieve when they perform the behavior under the specified conditions. Without a standard, it is impossible to determine when the students have achieved the objective.

Types of standards Standards can be classified in one of the following types.

Types of Standards	Example
Standard operating procedure	"... will comply with AF and local regulations."
No error	"... egress from the aircraft."
Minimum acceptable level of performance	"... compute the distance to the nearest five-mile increment."
Time requirements	"... take-off within five minutes."
Rate of production	"... run built-in test on the INS three times."
Qualitative requirements	"... complete an S maneuver smoothly."
Amount of supervision	"... identifies and corrects errors without assistance (ACC flying standards)."

Example

Some examples of standards are:

"... list the procedures for aborting a take-off" (without error implied).

"... within three miles."

"... with no more than 5% error."

"... IAW the Dash One."

"... in no more than two minutes."

Guidelines for Developing Objectives

Introduction

To this point, background information and the three parts of the objective have been discussed. The next stage is to actually develop objectives. The task list, which was developed in the previous phase, will be required in this effort. Using the information on the task list, what has been learned about objectives to this point, and the following guidelines, effective objectives can be developed.

Guidelines

Use the guidelines below when developing objectives.

Use the task list developed during the analysis phase.
Analyze each task or knowledge item on the task list to determine the number of objectives for each item.
Document each objective on a worksheet.
Analyze each objective to determine the skills, knowledge, and attitudes necessary to support the objective.
Use the supporting skills, knowledge, and attitudes to develop sub-objective(s).
Document any sub-objective(s) on the worksheet of the objective they support.

Hierarchy of Objectives

Introduction

Each task is made up of steps or procedures. Students must learn each of these steps or procedures before they can perform the particular task. Thus, objectives need to be specified for each step or procedure, in addition to the task itself. These different levels of objectives can be structured into an objective map that depicts the relationship of the various objectives and their sequence in the course. This map is called objective or learning hierarchy.

Purpose

The purpose of an objective hierarchy is to depict the relationship of objectives so that the most effective and efficient training sequence can be developed.

Classification of objectives

Objectives can be classified into two categories. These categories are shown below.

Category	Description	Other Names
Terminal	An objective the learners will be expected to accomplish when they have completed the instruction. It may contain several subordinate objectives.	Primary Main End
Enabling	An objective that the student must attain in order to accomplish a terminal objective.	Secondary Subordinate Supporting

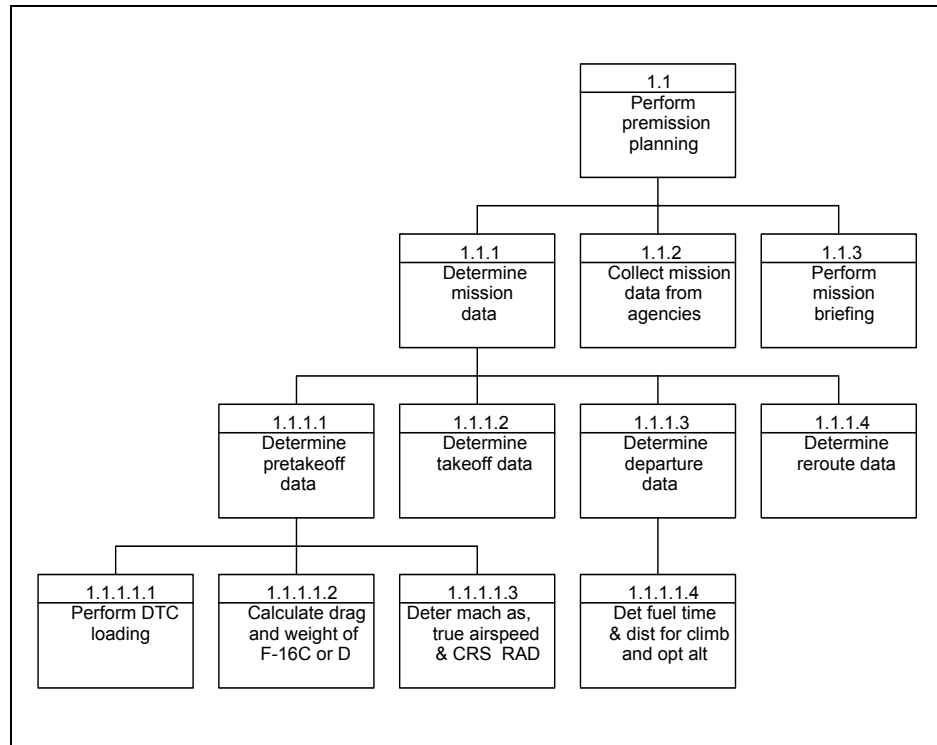
Examples of terminal and enabling objectives

Using Figure 11 as an example, the **Terminal Objective** is to "perform permission planning." All other objectives in the figure, such as "determine takeoff data" and "perform DTC loading," are **Enabling Objectives**.

Examples of task/objective hierarchy

Figure 11 and the following table shows examples of a task hierarchy and the task/objective hierarchy statements, which are derived from the task hierarchy itself.

Figure 11 Task Hierarchy



Starting with the terminal objectives at the top, the question is asked: "To be able to perform as specified in the objective, what essential skills, knowledge, or attitudes must the individual possess?" This will yield a number of major components. For each component, the question is asked again. The output of this procedure is a multilevel hierarchy in which the objectives at any one level of a hierarchy leg are prerequisite and essential to performing the objectives at the next higher level. A completed objective hierarchy reveals all of the objectives that are to be learned. It also specifies the coordinate and subordinate relationships, suggests the order in which they should be learned, and cross-references enabling objectives across legs of the hierarchy.

The hierarchy can be depicted graphically or as statements numbered to reflect the hierarchy.

Examples of task/objective hierarchy (Continued)

TASK/OBJECTIVE HIERARCHY STATEMENTS			
Objective Number	Behavior Statement	Condition	Standard
1.1	Perform pre-mission planning	Given a mission, all relevant mission information, and a copy of T.O. 1F-16C-1-1	
1.1.1	Determine the mission data	Given a mission, all relevant mission information, and a copy of T.O. 1F-16C-1-1	
1.1.1.1	Determine pre-takeoff data	Given a mission, all relevant mission information, and a copy of T.O. 1F-16C-1-1	
1.1.1.1.1	Load the DTC	Given a suitable DTC loader/reader	Must be done IAW T.O. 1F-16C-1CL-1
1.1.1.1.1.1	Label data transfer equipment (DTE) main components	Given a graphic representation of data transfer equipment	Must correctly complete 85% of the quiz/test questions to pass
1.1.1.1.1.2	Describe data transfer equipment (DTE) components	Unaided and in writing	Must correctly complete 85% of the quiz/test questions to pass
1.1.1.1.1.3	Describe the information that can be transferred by the DTE	Unaided and in writing	Must correctly complete 85% of the quiz/test questions to pass

Note the numbering used in the table. The numbering is used to identify the terminal and enabling objectives. These numbers are useful later when the objectives are sequenced for training, lesson materials are designed, and tests are developed for the objectives.

Prioritizing, Clustering, and Sequencing Objectives

Introduction

Once the objectives and sub-objectives have been identified, the next step is to prioritize, cluster, and sequence them into units of training. A unit of training is defined as any unit of training such as a course, module, block, or lesson. Guidelines for prioritizing, clustering, and sequencing objectives are provided in this portion of the section. Additional information on clustering and sequencing objectives can be found later in this chapter under the section “Designing Training Activities.”

Who is responsible?

The curriculum developer and the SMEs for the flying organizations are responsible for prioritizing objectives, as necessary. Also, the developer or development team is responsible for clustering and sequencing objectives.

Prioritize objectives

Prioritizing objectives may not be required in all training development projects. However, as the Air Force budget continues to shrink, you may be faced with the need to prioritize the objectives in order to provide the necessary training. For example:

“You need four days to train students on the Flight Director system. However, due to scheduling constraints you can only have three days.”

Guideline

There is a simple guideline to follow if faced with this situation. That guideline is to have SMEs in the flying organizations prioritize the objectives that are to be taught. Once the objectives have been prioritized, the curriculum developer designs the training to cover as many of the objectives as possible in three days.

When Should You Prioritize?

Objectives should be prioritized if there is a possibility that a resource constraint will not allow all objectives to be taught. Decisions on prioritizing objectives can often be made during the Training Planning Team (TPT) meeting.

Clustering objectives

Clustering or grouping objectives allows logical and meaningful units of training to be designed. Without clustering, it would be impossible to design effective and efficient training. Four basic guidelines for clustering objectives are provided.

Techniques for Clustering Objectives into Individual Lessons	
Cluster objectives that are prerequisites to other objectives. For example – Basic flying skills and knowledge may be required for many tasks in a course; therefore, they may be clustered in the same unit and taught in the core training.	
Cluster objectives that are related to the same system or engage the same type of action. For example – All tasks related to the operating of a particular piece of navigation equipment on an aircraft may be clustered into a unit.	
Cluster objectives with common skills and knowledge. For example – Several flying maneuvers (tasks) may require identical skills and knowledge to perform.	
Cluster objectives with potential for the same training method or delivery system. For example – Knowledge objectives may utilize a training method such as a lecture while skill objectives may be taught by demonstration/performance and clustered together. Also, objectives with the same type of learning may be grouped together to facilitate learning such as classroom, equipment.	

Sequencing objectives

Properly sequencing objectives plays a key role in the effectiveness and efficiency of training design. Improperly sequenced objectives can result in training being provided at the wrong time for effective learning, which results in a waste of resources. Properly sequencing objectives involves sequencing objectives within units or modules, as well as the course itself. Two basic guidelines for sequencing objectives are provided below.

**Sequencing
objectives
(Continued)**

Guidelines for Sequencing Objectives	
Teach prerequisite skills and knowledge first. For example – A student should be taught aircraft engine operation prior to being taught how to start the engine.	
Follow the fixed sequence or logical order in performing a task. For example – The student should be taught to perform cockpit checks prior to being taught to start the engine.	
Place the more easily learned and familiar objectives early in the sequence with the more complex and unfamiliar objectives. For example – A student should be taught what ailerons are and how they work prior to being taught how to do an aileron roll.	

Section D

Develop Tests

Introduction

At this point, the objectives have been developed, clustered, and sequenced for the course. The next task in the training design process is to develop tests to assess the student's attainment of the learned capability specified in the objectives. To ensure that tests adequately measure the objectives they support, the performance required in the test must match the performance required in the objective. This section will address the various aspects of tests and test development.

Purpose

The primary purpose of testing is to assess the student's attainment of the behavior specified in the objective. Other purposes of tests are to:

- Identify and correct problems or weaknesses in the training.
- Indicate instructor proficiency.

Testing concepts

The Air Force measurement program is based on the concept of criterion testing, which is basically a go/no-go type of testing. This form of testing rates the student with respect to the standards of performance that are specified in the objectives. To attain an objective, the student must meet or exceed the standard specified in the objective. All terminal objectives selected for training must be tested. Enabling objectives can be randomly selected as long as they assess the student's attainment of the specified behavior.

Develop a test plan

The test plan may be developed as a separate document or as part of the training development plan or evaluation plan. The primary areas of concern in the plan are:

- How to handle student failure
- How to remediate a student(s)
- How tests are administered, scored, and trended
- When student should face flying evaluation board (FEB)

If a computer-managed testing program is used, the test plan should identify how it will be carried out and who is responsible.

Types of test

As a curriculum developer, you will likely be required to develop one or more different types of tests. The basic types of tests used in the Air Force are described below.

Type of Test	Purpose of Test
Criterion	Used to measure the student's attainment of the objective. Used to measure the effectiveness of the instruction.
Diagnostic	Used to determine attainment of supporting skills and knowledge necessary to perform the terminal objective. Used during validation to predict success, to identify and correct weaknesses in the instruction.
Survey	Used to determine what prospective students already know and can do before receiving instruction. Used during development of instruction to gather data for design of instruction.

Characteristics of tests

There are several characteristics to be considered when developing tests. These characteristics ensure the tests measure what is intended each time they are administered. The characteristics are shown in the following table.

Characteristic	Definition
Validity	Content: Degree to which the test measures what it is intended to measure Predictive: Degree to which the test predicts performance
Reliability	Degree to which the test yields the same results consistently Test-Retest: Consistency across two administrations to the same students Split-halves: Consistency across two forms of the same test
Usability	Tests that are easy to administer, score, and interpret

**Comparison of
performance and
predictive tests**

In the past, most predictive tests were written paper-and-pencil type tests, because they are easy to produce, administer and score. The most common types of written test questions are essay, short answer, fill-in-the-blank, labeling, multiple-choice, matching, and true-false. Today's media provide other testing options. Computers provide different types of input systems that can have a high degree of fidelity with real-world tasks. Even a simple input device such as a joystick or a mouse allows for identification by pointing with a cursor. More elaborate devices such as magnetic field detectors, infrared detectors, etc., allow the computer to detect even more complex behavior.

How does an instructional designer decide what type of test to construct or what type of item to use? The best type of test is one that gives the decision-maker the best information regarding the student's mastery of the objective. Different types of test items have advantages and disadvantages with regard to good test construction. These advantages and disadvantages have to be considered in terms of validity and reliability of the test.

Predictive Test Item	Performance Test Item
Requires students to demonstrate knowledge by responding to various types of written questions. Emphasizes verbal or symbolic aspects. May require students to find, read, and use technical materials. Items are knowledge the student should learn to perform or make decisions on the job. Items are independent questions, not dependent on sequence. Errors on one item should not affect performance on another item.	Requires students to accomplish a job-like task under controlled conditions. Emphasizes nonverbal aspects. May require students to find, read, and use certain technical material (job aids, for example). Items are skills that students should perform, or the decisions they may make on the job. Items are dependent on sequence in which they are presented. Errors early in the sequence may affect final outcome of the task.

Test construction factors

Several key factors should be considered when constructing tests.

What to measure. Analysis of objectives should identify what should be measured. To determine what to measure, list the tasks to be performed or objective statement to be covered by the test. One or more test items may be needed to adequately measure each objective. Tests should measure application of principles, knowledge of factual information, ability to perform task, and transfer of knowledge and skills to solve similar problems.

This is the most important aspect of test construction. If the conditions of testing are not consistent with the objectives then the test will not measure the desired behavior.

Testing level. The level of testing (know, comprehend, etc.) should correlate with the stated level of learning for that portion of the instruction being tested—no higher and no lower.

Test length. Adequate coverage of the objective is the major factor in determining the length of test that is required. Longer tests are normally more reliable since they usually cover the material better.

Selection and arrangement of test items. Select test items that cover the most essential and significant portions of the material. Test items selected should be clear, concise and well written to minimize misunderstandings. Items of the same type should be grouped together in a test, if possible. Individual test items should also be arranged in approximate order of difficulty, which allows the students to progress as far as they can without spending excessive time on difficult items at the first part of the test.

Testing level. The level of testing (know, comprehend, etc.) should correlate with the stated level of learning for that portion of the instruction being tested – no higher and no lower. They are the fixed conditions that determine this level.

Test construction factors (Continued)

Test length. Adequate coverage of the objective is the major factor in determining the length of test that is required. Longer tests are normally more reliable since they usually cover the material better. However, a very long test covering many different skills may be much more unreliable than a very short test covering only one skill.

Selection and arrangement of test items. Select test items that cover the most essential and significant portions of the material. Test items selected should be clear, concise and well written to minimize misunderstandings. Items of the same type should be grouped together in a test, if possible. Individual test items should also be arranged in approximate order of difficulty, which allows the students to progress as far as they can without spending excessive time on difficult items early in the testing.

Test development guidelines

There are many good tools / models used by curriculum developers to determine which test type would best measure attainment of the desired behavior. AFH 36-2235, Volume 2, lists several. Specific guidelines for constructing different test formats are provided.

Test Type	Page
Multiple choice	119
True / false	120
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Completion	122
Labeling	123
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Performance test using a process checklist	126
Performance test using a product checklist	127

**Procedures to
develop written
tests**

When developing written test items, follow these steps.

Step	Description
1	Determine the test format and the number of items per objective.
2	Generate required test items.
3	Arrange test items (logical, simple-to-complex, and procedural).
4	Write directions for test administration.
5	Review test for accuracy and completeness.
6	Publish test in adequate copies.

**Constructing
written tests**

As a curriculum developer, you will need to be able to write effective tests in order to measure what the students have learned or can do. The following information is provided on preparing the most common types of written tests:

- Multiple Choice
- True/False
- Matching
- Completion
- Labeling or Identification
- Essay

Multiple choice

Multiple-choice tests are probably the most used type of written tests. They test recall, problem-solving skills, application of facts and principles, and understanding. A multiple-choice item consists of a stem (a question or uncompleted statement), a correct response, and distracters (incorrect responses).

Example

Directions—Carefully read the questions or statements below and circle the correct response. There is only one correct response.

1. What is the minimum continuous level flight airspeed (lock point)?
 - a. 142 KTAS
 - b. 151 KTAS
 - c. 181 KTAS
 - d. 184 KTAS

Construction Guidelines

Do not use the articles "a" and "an" at the end of the stem; this tends to indicate the correct answer.

All responses should follow grammatically from the stem.

All responses should be of approximately the same length.

All responses should have a similar grammatical structure.

All responses should use similar terminology.

Provide as many responses as necessary, but normally no less than three.

Position the correct response randomly throughout the test.

Limit the use of responses such as "none of the above" or "all of the above."

Distracters should be plausible, but incorrect.

Numerical responses should be arranged in ascending or descending order.

True / false

A true/false test should be used sparingly since the chance of random guessing is high. True/false tests may be used when you want a student to identify a completely true or completely false statement.

Example

Directions—Carefully read the question below and circle true or false to indicate the correct response.

True False 1. The minimum continuous level flight airspeed (lock point) is 151 KTAS.

True False 2. The L/D maximum airspeed is 85 KTAS electrical.

Construction Guidelines

Include only one idea in each statement.

Place the crucial element at or near the end of the statement.

Avoid using negatives, as they tend to confuse students.

Do not use absolutes such as "all," "every," "none," and "never."

Do not use vague terms such as "some," "any," and "generally."

Matching

A matching test is used to measure a student's ability to identify and discriminate among related or similar items. Matching items normally use two columns of related items, and students are required to match a series of items listed in one column with related items in the other column. It provides a way to test multiple knowledge simultaneously.

Example

Directions—Listed in the two columns below are words and phrases. Select the phrase in the right-hand column that defines the word in the left-hand column and place the identifying letter in the blank space provided. Some of the phrases may be used more than one time, while others may not be used at all. The first item is answered as an example.

- | | |
|-----------------------|---|
| 1. - 5. | a. The ability to detect small differences in the mastery of the subject matter. |
| <u>c</u> Validity | b. The degree to which a test is easy to administer, score, and interpret test results. |
| ___ Reliability | c. The ability to measure what it is designed to measure. |
| ___ Objectivity | d. The degree to which adequate numbers of test items are used for each objective. |
| ___ Comprehensiveness | e. The ability to give consistent results. |
| ___ Differentiation | f. Often determined by correlating the original test scores with those obtained in a retest. |
| ___ Usability | g. Test score that is not influenced by bias or personal opinion of the score. |
| | h. Assumed to be present when a job is learned to a high level of proficiency within a reasonable time. |

Construction Guidelines

Provide clear, concise directions on how to match the items in the two columns.

Indicate if the responses may be used more than once or not at all.

Limit test items to a single area and the choices to a single subject matter category.

Arrange the responses in the same logical order.

Completion

A completion test item requires the students to recall and supply one or more key words that have been omitted from the statement. The word(s), when placed in the appropriate blanks, make the statement complete, meaningful, and true.

Example

Directions—Complete the sentences below by adding the correct word(s) in the blank spaces that are provided.

1. In a formation takeoff, wingtip clearance to be maintained is _____ to _____ feet.
2. During formation takeoff, altitude indicated by _____ and _____ should match that of lead throughout the takeoff.

Construction Guidelines

Leave blanks for key words only.

Keep items brief.

Make all blanks approximately the same size.

Grammatical cues to the correct answer, such as articles like "a" or "an" right before the blank, should be avoided.

Ensure that only one correct answer fits each block.

**Labeling or
identification**

A labeling or identification test is used to measure a student's ability to recall and label parts in pictures, schematics, diagrams, or drawings. This form of testing is most often used to measure recognition of equipment components or other concrete objects.

Example

Directions—Identify the numbered items of a CPU-26 computer. Place the correct answer in the space provided.

Construction Guidelines

Make all sketches, drawings or illustrations clear and of sufficient size. If possible, use the actual parts of a unit. Provide sufficient information to indicate what the equipment is and which part is to be labeled. The parts to be labeled or identified should be clearly pointed out by using lines or arrows. Ensure that only one definite answer is possible.

Essay

An essay test, which is not normally used in technical training, requires extensive discussion by the student. These tests should be used only when students are expected to think reflectively or creatively, to organize knowledge in the solution of a problem, and to express their solution in writing.

Example

Direction—Complete the essay question in 500 words or less. Use only one side of the paper to write your response.

Test Item—Describe the effect wind shears have on an aircraft during the landing approach.

Construction Guidelines

State essay item clearly so students know exactly what type of discussion is expected.

The essay item should ask for comparisons, decisions, solutions, cause-effect relationships, explanations and summaries.

When possible, use more essay items and limit the discussion on each.

Set limits on essay questions, such as time or number of words.

Determine how the question will be scored for objective grading.

**Procedures to
develop
performance tests**

When developing performance tests, follow these steps.

Step	Description
1	List steps/activities/behavior (process) or characteristics (product).
2	Note common errors that are made when performing the checklist.
3	Arrange the steps or activities and characteristics in proper order.
4	Review the checklist for accuracy and completeness.
5	Publish checklists in adequate quantities.

**Constructing
performance tests /
checklists**

Performance tests, which require the student to perform a task, usually take the format of a checklist. The checklist is developed to correspond to the steps or activities of the task being performed. During the performance test, an evaluator observes the student performing a series of steps or activities while rating the steps on a checklist (process evaluation). An evaluator may also rate the end product of a performance on a checklist (product evaluation). For operational flying, reaction time is often considered as well as the correct action to take. As the students gain experience, they are expected to improve.

**Performance
test using a
process checklist**

When a performance test requires the steps or activities to be rated, a process checklist is used. The checklist should contain all of the essential steps or activities for successful performance. The actual weapon system checklist should be used when possible, especially since different techniques can provide the same results. The courseware developed with the help of the SME may have to select only one technique for training and testing. The flying evaluation grade sheet is also used to record proper performance and to brief students on how well (or poorly) they did. Items are repeated in a phase of instruction until the desired standard is achieved. Constant monitoring by the student's flying supervisor allows for remedial action, when necessary. Following is an example of a process checklist.

Example

PROCESS CHECKLIST
MISSION BRIEFING ON OVERALL ROUTE, RADAR
NAVIGATION AND APPROACH PROCEDURE

Check	Step or Activity	Description of error
	1. Route and type profiles	
	2. Ground speed	
	3. Bank angles	
	4. Terrain obstacles/hazards	
	5. FLIR INS procedures	
	6. Fuel figures	
	7. Emergency airfields	
	8. Airborne radar approach	

Guidelines for Construction and Use

Use when the performance of steps or activities of a task are to be evaluated.

The step or activity must be observable.

Define all of the steps or activities of the task being performed.

Sequence steps or activities in order of performance.

Provide space for checking the performance of each step or activity.

Provide space for recording and describing errors.

**Performance
test using a
product checklist**

When a performance test requires the product of a process or a task to be evaluated, you will probably want to use a product checklist. The checklist should identify criteria or characteristics of product acceptability. Following is an example of a product checklist.

Example**PRODUCT CHECKLIST –
INTERPRETS AIRCRAFT INSTRUMENTS**

Yes	No	Product Criteria / Characteristics	Comments
		1. States degrees and direction of A/C pitch and roll within ± 5 degrees	
		2. IAS within ± 10 Kts	
		3. Altitude within ± 50 ft	
		4. Vertical velocity in correct direction and rate of change within ± 100 ft	

Guidelines for Construction and Use

Use a checklist when the objective requires the student to produce something.

Use a checklist when the product can be readily evaluated.

Use a checklist when there are no fixed or set procedures.

Identify the characteristics of the product.

Provide space on the checklist for product rating.

Provide space on checklist for comments about the product.

Section E

Review Existing Materials

Introduction

Developing training materials can be expensive and time-consuming. Therefore, after developing objectives and tests, review existing training materials to determine if materials exist that will support the course objectives. If materials are found, it is possible that they will not totally support the objectives. If so, don't hesitate to modify the material to fit your need. You may even use portions of existing materials to your advantage. The time you spend reviewing existing material will be time well spent.

Benefits

Using existing materials saves time, human resources, materials, and money.

Sources of materials

There are several sources for existing training materials, such as:

- DoD
- Other military branches
- Interservice organizations
- Other federal agencies
- Commercial
- Colleges and universities

Types of existing material

When reviewing existing training materials, you may find them in some of the following forms:

- Printed materials (e.g., textbooks, technical orders, handbooks, job aids)
- Slides
- Video
- Audio cassettes
- Computer-based [ICW, Computer-Assisted Instruction (CAI)]
- Training aids

How to select materials

To standardize the process and allow comparison between materials under review, use a job aid such as the one below to help select existing materials.

Job Aid Material Review Form

Evaluator _____

Date _____

1. Objective(s) the material supports _____

2. Type of Media _____

3. Evaluation of Material Poor Good Excellent

Content

Accuracy	1	2	3	4	5
Currency	1	2	3	4	5
Level	1	2	3	4	5

Structure

Organization	1	2	3	4	5
Sequence	1	2	3	4	5

Suitability

Supports Objective	1	2	3	4	5
User-friendly	1	2	3	4	5
Pace	1	2	3	4	5
Guidance	1	2	3	4	5
Feedback	1	2	3	4	5
Motivational	1	2	3	4	5
Measurement	1	2	3	4	5

4. What do I like about the material?

5. What do I dislike about the material?

6. Can the material be modified to improve its utility? If so, what should be done?

**Modifying
existing materials**

Sometimes you may find that existing material is available for use but it needs modification. When modifying existing materials you may:

Add new material such as information on the operation of a particular piece of equipment that was not covered in the existing material available.

Expand existing materials to include more detailed information, diagrams, illustrations and examples.

Delete materials that do not support your objective(s).

Update material to include current information, such as revised procedures, data, and to correct inaccuracies.

Re-sequence material to make it compatible with your training design.

**Additional
information**

For additional information on reviewing existing materials, see:

AFMAN 36-2234, Instructional System Development, Design chapter.

Dick, W. and Carey, L. (1990). *The Systematic Design of Instruction* (3rd Ed.). Glenview, Illinois: Harper Collins Publishers.

Knirk, F. G. and Gustafson, K. L. (1986). *Instructional Technology: A Systematic Approach to Education*. New York: Holt, Rinehart, and Winston.

Section F

Design Training

Introduction

If you cannot find existing materials that fit your needs, you should proceed to design your own training. Your design will determine the effectiveness and efficiency of the training system. Training design should be determined by what best meets the training needs rather than just using a particular training design that has always been used in your training organization.

Where to read about it

This section covers three topics.

Topic	Page
Determine Training Strategies	133
Design Training Activities	136
Select Media	138

Determine Training Strategies

Introduction

After the objectives and related tests have been developed and you know what behaviors are required, you should plan and develop the most effective and efficient learning environment using principles of learning. This process starts by determining the training strategies or plan you intend to use. A training strategy is necessary in order to manage the design of the training activities and the learning process.

Determining training strategies

Training strategies can be determined from the following issues:

- Student participation
- Student feedback
- Student pacing
- Training sequence

Student Participation

Active student participation is essential for learning to take place. Students learn by doing, thinking, and feeling—through answering questions, discussing, computing, manipulating, and putting ideas together. The training strategy ensures that students are active in the learning process and that they can apply or demonstrate what they have learned. Learning is a process in which students gain skills and knowledge, and form attitudes through their own activities, experiences, and motivations. For each type of learning, consider using the following strategies.

Type of Learning	Training Strategies
Skill	Demonstrate task that the student is to perform. Have student do each step of the task following the demonstration. Have student perform the entire task with minimum guidance.

**Determining
training strategies
(Continued)**

Type of Learning	Training Strategies
Knowledge	Provide drill and practice to reinforce recall. Use examples and non-examples to reinforce understanding. Provide opportunity to practice the knowledge in context.
Attitude	Use human modeling to shape student attitude. Use guided discussions for effective lessons. Give or withhold rewards.

Student Feedback

Students participating in the teaching/learning activity will need feedback on how well they are doing. The kind of feedback, as well as the scheduling of feedback, depends on the kind of learning. Feedback not only informs the students of how well they are doing, but also serves as a valuable source of motivation. The training strategy should provide each student with feedback, whether it is the result of a written test or instructor comments during the performance of a task. Ask frequent questions and provide feedback to address any possible student misunderstanding about the content.

Student Pacing

Pacing is the rate students go through the training. There are several ways to pace students' progress.

Group-Paced – Students progress through the training together as a group at the same rate. This is a very effective pacing method when training large numbers of students. However, it does not allow individuals to deviate from the group rate.

Group Lock-Step – The group progresses through the training at a predetermined pace, completing training on schedule. This is normally the most costly form of pacing. However, in cases where timing is critical, it is very effective.

Self-Paced – Students are allowed to work at their own pace through the training within certain parameters. This form of

**Determining
training strategies
(Continued)**

pacing is very effective in courses using CBT, interactive video and self-study.

Combination Pacing – Any of the above-mentioned forms of pacing may be used in combination.

Instructional Sequence

The following sequence considerations also determine training strategies.

Proficiency Advancement – This technique is used to advance students who have prior knowledge, practical experience, or are exceptionally fast learners. Students show their proficiency by passing a criterion test and may bypass the training in which they have passed the criterion test.

Multiple Track – A training sequence may be divided into various tracks to allow students to go through training best suited to their abilities and needs. The best track for a student is determined by a pretest.

Modular Scheduling – Training is divided into different modules and students are pre-tested to determine which modules of training they need. Modular scheduling is normally used only when the learning sequence is not critical.

Design Training Activities

Introduction

Design of the training activity depends largely on two factors – training sequence and size of the training segment. Effective and efficient training depends on how well you sequence and size the training.

Reasons for sequencing

Properly sequenced training provides:

Student motivation – Students learn best when they are motivated. Motivation often depends on a proper sense of direction. Early stages of training should provide a sense of direction. Properly sequenced training will provide direction and gives students a "mental" roadmap of where they are going and how they are going to get there.

Meaningful relationship – Proper sequence provides students with a pattern of relationships so that each training activity has a purpose. If the training is meaningful to the students, they will learn more easily and quickly.

Content consistency – Proper sequencing helps avoid inconsistencies in the training content. Carefully sequenced training will help eliminate gaps and duplication. Consistency of content ensures that skill progression is orderly and prerequisite skills and knowledge have been acquired prior to introduction of advanced subject matter content or performance of more complex tasks.

Sequencing training

There are several methods of sequencing training.

Job performance order – This method sequences training in the order in which the tasks and subtasks are performed. Tasks and subtasks arranged in this order are very effective, since it is an orderly process, which builds learning on learning and adds realism to the training.

Psychological order – This method of sequencing arranges the training content based on the ease of learning. Students are taught easier tasks first, and then the more complex tasks are taught. This method also includes the process of going from what students already know and proceeds to new information.

**Sequencing training
(Continued)**

Logical order – Normally, training activities should be designed to proceed from the simple to the complex or from known to unknown. However, training activities will not always lend themselves to this design method. In such a case, training activities may be designed using both performance and psychological order. This arrangement normally includes the whole-part-whole concept.

Guidelines for sequencing

Various sequencing methods can be used to design training activities based on training content and resource availability. When selecting methods, consider doing the following:

- Place easily learned objectives early in the training sequence.
- Provide common or "core" training early in the training sequence.
- Sequence sub-objectives with the objective they support.
- Place skills and procedures within each objective in job order when possible.
- Introduce concepts at the point where understanding the concepts is a prerequisite for successful performance.
- Provide prerequisite skills training before the time it is required for the job.
- Introduce skill or knowledge in the task where it is most likely or frequently used.
- Provide practice of skills and concepts in areas where transfer of like or related skills is not likely to occur.
- Place complex and cumulative skills later in the training sequence.

Optimum size of training unit

There are no hard and fast rules on the proper size or increment of training. There is a natural tendency to play it safe and provide more training than is necessary. This costs valuable resources and normally causes boredom on the part of the student. A good approach to designing the size or increment of training is to start with minimal training and rely on validation to show if more training is needed. This method, combined with evaluation feedback, will indicate if more training is required. If you provide more training than is necessary in the beginning, it will be difficult to determine until feedback is received from the field.

Select Media

Introduction

Although selection of training methods and selection of media are discussed individually, they can't always be considered separately. No single medium is the most appropriate choice for every training situation. A proper medium ensures that information is presented to the students by the most effective and efficient means possible. **Note: As a reminder, the media selected for the training system have a direct impact on resources such as personnel, facilities, and funds that were identified during the planning stage of the ISD project.**

Definition

Media are the means, instruments, or materials used to communicate information—in other words, the means used to give information to the students. Examples of media include classroom instructor, study guides, CBT, satellite training, interactive video, or numerous other types of media.

Types of media

There are several types of training media, as shown below.

Types of Media	Examples
Instructor/Tutor	Lecturer Demonstrator Tutor/Coach
Traditional Audio/Visual Devices	Chalkboards Transparencies Overhead projectors Slides Pre-narrated slides Microfiche Film strips (silent/pre-narrated) Video tapes Slide/workbook/tape recorder combinations

**Types of media
(Continued)**

Types of Media	Examples
ICW	CBT (traditional) IVD CMI
Print	Workbooks Study guides Job aids Training manuals Programmed instruction booklets
Training Devices and Simulators	Actual equipment trainers Flight training simulators Part-task trainer Computer simulation

**Characteristics
of media**

Media have various characteristics that are either suitable or unsuitable for particular training situations. Consider these characteristics carefully to ensure that the appropriate medium is selected for the training system. The following table lists the advantages and limitations of each of the following mediums.

Printer materials
Overhead transparencies
Audiotape recordings
35-mm Slide Series
Multimedia
Video and Film
Interactive Courseware (ICW)

Printed materials**Advantages**

1. Include common types of materials.
2. Have wide variety of applications.
3. Simple types quick to prepare.

Limitations

1. Sophisticated types more costly to prepare.
2. Require suitable reading ability.

Overhead transparencies**Advantages**

1. Can present information in systematic, developmental sequences.
2. Use simple-to-operate projector with presentation rate controlled by instructor.
3. Require only limited planning.
4. Can be prepared by variety of simple, inexpensive methods.
5. Particularly useful with large groups.

Limitations

1. Require special equipment and skills for more advanced preparation.
 2. Are large compared with other projectors.
-

Audiotape recordings**Advantages**

1. Easy to prepare with regular tape recorders.
2. Can provide applications in most subject areas.
3. Equipment is compact, portable, and easy to operate.
4. Flexible and adaptable as either individual elements of instruction or in correlation with programmed materials.
5. Duplication easy and economical.

Limitations

1. Have a tendency for overuse, as lecture or oral textbook reading.
2. Fixed rate of information flow.
3. Low fidelity of small portable recorders.

Note—If contractor-developed, audio tapes are typically made by a professional narrator; hence, they are not "easy" to prepare or revise.

35-mm slide series**Advantages**

1. Require only filming, with processing and mounting by film laboratory.
2. Result in colorful, realistic reproductions of original subjects.
3. Prepared with any 35-mm camera for most uses.
4. Easily revised and updated.
5. Easily handled, stored, and rearranged for various uses.
6. Increased usefulness with tray storage and remote control by presenter.
7. Can be combined with tape narration for greater effectiveness.
8. May be adapted to group or to individual use.

Limitations

1. Require some skill in photography.
 2. Require special equipment for close-up photography and copying.
 3. Can get out of sequence and be projected incorrectly if slides are handled individually.
-

Multimedia**Advantages**

1. Can demand attention and create strong emotional impact on viewers and/or users.
2. Condenses time and materials required to upgrade skills by using a number of training technologies.
3. Effects rapid skill transfers by providing the ability to implement changes to meet new or revised training requirements.
4. Computer-based multimedia manages feedback and evaluation by tracking information as the user interacts with the media.
5. Computer-based multimedia presents information in different content formats such as motion video, audio, still images, graphics, animation, text, etc.

Limitations

1. Require additional equipment, complex setup, and careful coordination during planning, preparation, and use.
 2. Equipment and production costs may be high for complex programs.
-

Video and film**Advantages**

1. Particularly useful in describing motion, showing relationships, and giving impact to topic.
2. Allow instant replay of video recording.
3. Videotape is reusable.
4. Easy to record lip sync on videotape.
5. May include special filming techniques (animation, time-laps).
6. Combine still and motion on videodisc.
7. Standardized film projector available everywhere.

Limitations

1. High cost for studio production equipment.
2. High cost in time and resources for revision.
3. Resolution limited with video for fine detail.
4. Incompatibility of particular video format types.
5. Value of investment in motion picture equipment reduced as video replaces film.

Note – Videotape and videodisc are fast replacing 16mm film medium.

Interactive Courseware (ICW)**Advantages**

1. Presents text information and graphic images.
2. Interacts with learners on individual basis through asking questions and judging responses.
3. Maintains record of responses.
4. Adapts instruction to needs of learner.
5. Controls other media hardware.
6. Can interface computer and video for learner-controlled programs.

Limitations

1. Requires computers and programming knowledge, except for low to mid-level CBT.
 2. Requires essential hardware and software for development and use.
 3. Incompatibility of hardware and software among various systems.
-

Guidelines for selecting media

Several guidelines for media selection are:

Select media that do not conflict with the specific training environment.

Select media that effectively meet the training objectives.

Select media that support the training strategy.

Select media that allow individualization of training to the greatest extent possible.

Select media with development time, know-how, and dollar resources in mind.

Select media that are effective and cost-efficient.

Media selection for integrated activities

Most types of complex skills involve multiple objectives from different domains of learning. A skill that involves two or more objectives from different learning domains involves integrated learning activities. Media selection for integrated learning activities must take into consideration the enterprise and the learner's schema, metaskills, and experience.

Enterprise. An enterprise is an integrated, purposeful activity that usually leads to accomplishment of a goal. For example, an individual might have an enterprise to build and fly an airplane. An individual does not have to have all the prerequisite skills to engage in an enterprise. The importance of an enterprise is that it is purposeful and relevant to the learner. This motivates the learning behavior necessary to complete the component tasks.

Schemas. A schema is an individual's organization of knowledge. Schemas may take the form of scripts (a kind of story or scenario that organizes information) or frames (a structure that looks like a table or matrix into which information fits). Different levels of learners have different types of schemas. A novice learner (in a particular subject area) has a very sketchy schema or structure into which new information can be placed. An experienced learner (one who has had some training in a subject area) has a better structure and therefore is a quicker learner than the novice. Finally, an expert has a very highly developed schema and is probably capable of rapid learning with very little learning support.

**Media selection
for integrated
activities
(Continued)**

These are simple definitions of 'enterprise' and 'schema,' and address little about how this effects media selection. Enterprise and schema are more concerned with sequencing and whole-task practice than with media.

Metaskills. Metaskills are cognitive strategies that an individual applies to the processing of new information in a novel situation (a scenario not previously experienced). These skills include chunking or organizing new information, recalling relevant schemas, adding the new information to the old schemas, and creating new schemas. Although metaskills are probably subject-independent, different individuals have different metaskill capabilities depending upon their experience with a particular subject content. For example, an expert has developed metaskills and can relate better to a novel situation than a novice. An expert is more efficient at processing new information and applying it to the novel situation.

Learner Experience. It is helpful to know how experienced a learner is when selecting media or teaching strategies. The more experience, the higher the level of metaskills and strategies the learner will be able to employ. Experienced learners can deal with larger steps of instruction and more complex learning environments. Novices, on the other hand, require simplification of complex contexts so they don't experience information overload while learning.

Section G

Update Training Development Plan

Introduction

The training development plan that was developed during initial ISD project planning may have already been updated during the analysis phase. This plan, which serves as the roadmap for training development, may also need to be updated at the end of the design phase if there have been changes that impact it. If the plan is to be an effective tool for managing training development and implementation, it will need to be periodically updated.

Why update the plan?

The training development plan should be updated at the end of the design phase, as applicable; to reflect any changes that impact the training development process resulting from the activities in the design phase. If the training development plan is not updated, it will not be an effective tool for managing the training development process.

Who is responsible?

Keeping the training development plan updated with current and accurate information is the responsibility of the curriculum developers. They should update the plan at the end of the design phase, as applicable.

What should be updated?

At the end of the design phase, the training development plan should be updated with new or revised information, such as:

- Changes to the overall training development
- Refinements to project definition
- Revisions to the resource requirements
- Changes in resource constraints
- New or revised milestones
- Addition or deletion of tasking

Chapter 6

DEVELOPMENT

Overview

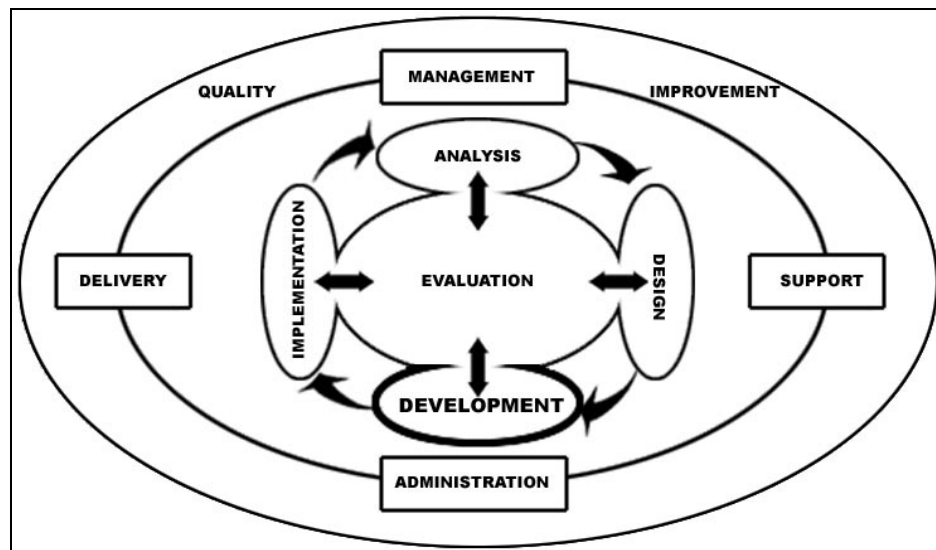
Introduction

Once the objectives and tests have been developed and training strategies and activities have been selected, you are ready to implement your design in the **development phase**. Some of the tasks in this phase include writing training materials, producing training media, and developing ICW. As a curriculum developer, this is where all your efforts from the earlier phases of ISD start to come together.

Where are you in the process?

Figure 12 depicts the ISD model with the development phase highlighted.

Figure 12 Development Phase



Objectives

The objectives of this chapter are to:

- Write tasks involved in developing training.
 - Prepare installation of training information management systems.
 - Review and critique plans that need to be updated.
 - Plan and execute the training validation process.
-

**Where to read
about it**

This chapter contains seven sections.

Section	Title	Page
A	Prepare Course Documents	147
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C	Develop Training Alternatives	161
D	Install Training Information Management System	162
E	Update ISD Evaluation Plan	163
F	Update Training Development Plan	165
G	Finalize Training Materials	166

Section A

Prepare Course Documents

Introduction

Each aircrew-training course normally has a course control document and several other related documents that are used to control, standardize and support presentation of the training course. These documents are essential to an effective, cost-efficient training program.

Where to read about it

This section covers two topics.

Topic	Page
Course Syllabus	148
Other Syllabus-Related Documents	154

Additional information

For additional information on course documents, see:

AFMAN 36-2234, Instructional System Development, Development chapter.
AFMAN 36-2236, Handbook for Air Force Instructors.

Course Syllabus

Introduction

A course syllabus is a blueprint for conducting training in a given course. In some training organizations, a Plan of Instruction (POI) is used for the same purpose; in DoD Inst. 29612, it is called the Course Control Document.

Purpose

A course syllabus is used to standardize training and control its quality. Additionally, the syllabus allows training and support managers to plan resources such as aircraft, fuel, bombs and ranges.

Who is responsible?

Training managers have the ultimate responsibility while curriculum developers are responsible for preparing the course syllabus. They are also responsible for keeping it current and accurate.

What is in the course syllabus?

Since aircrew operational training affects so many different USAF agencies, a standardized model for the syllabuses is required and is shown below.

Chapter	Title	Content
1	Course Accounting	Course title Course number Course purpose Course description Course prerequisites Status upon graduation Multiple tracks identified, if applicable Academic and flying inventory

**What is in the
course syllabus?
(Continued)**

2	Course Training Standards	Training elements to be accomplished Standards of accomplishment for each element Course flowmap Training schedule matrix
3	Academic Inventory	Lectures and description Workbook and description Sound/slides and description ICW lessons and description
4	Aircrew Training Devices	Mission statement and objective for each device training session
5	Flying Training	Special instruction on flying portion of training Explanation of sorties Mission outline Elements to be accomplished
6 (Optional)	Criterion- Referenced Objectives	Terminal objectives

**Course syllabus
format**

The format of course syllabuses is flexible. They should be usable, document the plan for training, and meet the needs of the training organization as well as others. Examples of a course syllabus cover and first pages are included on the following pages.

Example – Course Syllabus

DEPARTMENT OF THE AIR FORCE
Headquarters, Air Combat Command
Langley Air Force Base, Virginia 23665-5001

ACC SYLLABUS
Course No. AB00000

USAF OPERATIONAL TRAINING COURSE

E-3 MISSION CREW COMMANDER

2 JULY 1992

INTRODUCTION

This syllabus prescribes the overall training strategy and average amount of instruction required for a student having the entry and prerequisites to attain the course goals. Units tasked to implement this syllabus are responsible for ensuring that each student demonstrates the knowledge and skill proficiencies set forth in the course training standards. Within syllabus and other directive constraints, the amount and level of training devoted to mission elements, events, subjects or phases should be adjusted, as required, to meet the needs of individual students.

Instructions governing publication and revision of ACC syllabuses are contained in ACCR 8-1.

OFFICIAL

JOHN DOE, General, USAF
Commander

JOHN SMITH, Colonel, USAF
Director of Information Management

Example – Course Syllabus (Continued)**CHAPTER 1
COURSE ACCOUNTING****SECTION A – COURSE DESCRIPTION**

1-1. COURSE TITLE/NUMBER. E-3 Mission Crew Commander (MCC) Basic Qualification Course, E3000BQOBX.

1-2. PREREQUISITES. These requirements will be completed prior to the formal course start date for the track being entered. The MCC course is divided into three tracks

- a. Track 1, Air Surveillance Officer (ASO) upgrade to MCC.
 - (1) Must be a Mission Ready ASO, AFSC 1744D
 - (2) Must be a Major or Major selectee
 - (3) Must have 300 flight hours as an ASO in the E-3 aircraft
- b. Track 2, Senior Director (SD) upgrade to MCC.
 - (1) Must be a Mission Ready SD, AFSC 1711/1716.
 - (2) Must be a Major or Major selectee
 - (3) Must have 300 flight hours as a WD and SD combined.
- c. Track 3, Personnel with no prior experience in AFSC 17XX or 17XX personnel with no E-3 experience.
 - (1) Current Flight Physical Class III. Physical must be current for a minimum of six months after reporting to Tinker AFB.
 - (2) Current Physiological training, including rapid decompression, before departure from present duty location. Training must remain current for one year from reporting date at Tinker AFB.
 - (3) Must complete Basic Survival Training Course S-V80, and either Water Survival Course S-V86-A or S-V90-A before departing from present duty location.

Example – Course Syllabus (Continued)

- (4) Complete Life Support Training at Tinker AFB.
- (5) Must have a Top Secret and SCI security clearance.
- (6) Graduate of accredited Weapons Control school and have AFSC 1711/1716 with one year experience in Automated Radar Systems (Sage, Buic, 407L, 412L).
- (7) Those personnel not satisfying the requirements of item (6) will complete the academic and simulator portion of the ASO/WD Basic Qualification Course (E3000BQOGX/E3000BQOBX).
- (8) Must be Major or Major selectee.

1-3. PURPOSE/STATUS UPON GRADUATION. To train personnel meeting course prerequisites to basic qualification (BQ) status in the Mission Crew Commander crew position in the E-3. Graduates receive an E-3 rating of BQ IAW ACCM 51-60.

1-4. LOCATION. 522 AWAC Division, Tinker AFB, Oklahoma.

1-5. DURATION.

- a. Track 1 will be 43 training days divided into 13 ground training days and 30 flying training days.
- b. Track 2 will be 45 training days divided into 15 ground training days and 30 flying training days.
- c. Track 3 will be 64 training days divided into 20 ground training days and 44 flying training days.

1-6. AMOUNT.

	TRACK 1	TRACK 2	TRACK 3
a. Academic Training Hours	86	92	117
b. Aircrew Training Device Hours	11	11	27
c. Flying Sorties/Hours	8/64	8/64	13/114

Example – Course Syllabus (Continued)**SECTION B – FLYING INVENTORY**

1-7. The following charts show the average number of effective sorties required by each student.

(ILLUSTRATION) TRACKS 1 and 2

(ILLUSTRATION) TRACK 3

SECTION C – AIRCREW TRAINING DEVICE INVENTORY

1-8. MISSION SIMULATOR.

TRACK 1 TRACK 2 TRACK 3

Other Syllabus-Related Documents

Introduction

The syllabus is a control document for managers of the training program. Other syllabus-related documents that support training are developed by curriculum developers and are used by the instructor and students.

Who is responsible?

Curriculum developers are responsible for ensuring that each component or related document is available to support the training program.

Types of related documents

There are many syllabus-related documents that support the various aircrew-training programs. Some programs may have requirements for specific syllabus-related documents that other programs do not need. Several syllabus-related documents that every aircrew program will likely need are:

- Instructor guide
- Student study guide
- Phase manual
- Mission guides

A brief description of the above-mentioned documents is provided below.

Instructor guide

The instructor guide is the lesson plan that instructors use to present the material to the students. It can be written as a narrative, an outline, or both. A narrative is an aid for the new or substitute instructor or for material that is not presented often enough for the instructor to maintain proficiency. Instructors who are proficient with the instructor guide in the narrative form may choose to use only the outline.

The parts of the instructor guide may vary in presentation order but it normally contains the:

- Introduction – motivation, preview, review (perhaps a war story)

**Instructor guide
(Continued)**

Presentation – material presented with spot summaries and transitions

Summary – summary of what was just presented

Instructor Guidance – information on what students will be doing next, i.e., test or quiz, reading assignment and next class assignment

The format of the instructor guide may change as a result of validation or to meet the training need.

Student study guide

The student study guide can be presented in any format that provides assistance about the material to be covered. The objectives are given to the students so they will know what is expected of them. The format of the student study guide may change as a result of validation or to meet the training need.

Phase manual

The Dash One and other TOs may confirm all the information the students need but they are often written at a level that may be difficult for new students. Thus, phase manuals are developed to extrapolate the information for specific areas of flying. Phase manuals are normally segmented into:

Conversion or transition

Air to air

Air to surface

These manuals must be technically correct and will normally require coordination with the operational flying manager to ensure accuracy.

Mission guides

Mission guides may be developed for each flying event. They identify:

Strategy for the mission

What support is needed

Type of instructor required, if any

**Mission guides
(Continued)**

Routes to be taken
Goals of the mission
Number and types of bombs, bullets, or others

The mission guide can be included in the syllabus (Chapters 4 and 5) or can be developed as a separate document.

Format guide

Perhaps the most important requirement for syllabus-related documents is consistency within the training program. All instructor guides, student study guides, phase manuals and mission guides should follow a predetermined format. A format or style guide is a good way to ensure that all developers are providing professional-looking products that are effective and cost-efficient.

Section B

Develop Training Materials

Introduction

In the design phase, the training method and medium best suited for the training need were selected. At this point, you are ready to start developing the medium to implement the training design. Developing training materials is a time-consuming and exacting task regardless of the medium you use. It is essential that a quality medium be developed, since it is the vehicle that carries to the students the information that is to be learned.

Description

Media are the means, instrument, or material used to communicate information to the student. Examples of media range from the classroom instructor using a lesson plan to study guides, CBT, satellite training, interactive video, or numerous other types.

Types of training materials

Training can be delivered using media such as:

- Instructor
- Print-based
- Slide/tape
- Audio/video tapes
- CBT
- Interactive video
- Training devices/aids
- Satellite (i.e., distance learning)

Factors in media development

Several factors affect the development of training media and materials. The relative importance of each of these factors depends on the medium selected. These factors are:

- Development personnel required
- Development time required
- Development cost required

Development activities

Training material development requires many activities. The type and number of activities depend upon the type of training materials being developed. Some of the most common development activities are listed below.

Medium	Development Activity
Print	Draft/write material Edit material Publish material
Transparencies	Draft transparency Generate reproducible transparency Reproduce transparency
Slide/Tape	Storyboard/script slide or tape Shoot and edit slide/tape Narrate audio Print slide/tape
Videotape	Storyboard/script Shoot and edit video Develop audio
CBT	Storyboard/script Develop graphics Program/code computer
Interactive Video	Storyboard/script Shoot and edit video Develop graphics Develop audio Program/code computer

Who is responsible?

Developing training materials normally involves teamwork and requires various skills. Curriculum developers are responsible for planning, scheduling, and making sure the training materials are produced. Team members required for production of different media are listed below.

**Who is responsible?
(Continued)**

Medium	Development Role
Print	SME Curriculum Developer Editor Graphic Artist
Transparencies	SME Curriculum Developer Graphic Artist Editor
Slide/Tape	Script Writer SME Photographer Narrator/Editor
Videotape	Script Writer SME Video Producer, Editor, Photographer Sound Technician
CBT	Script Writer SME Graphic Artist CBT Author
Interactive Video	Script Writer SME Video Producer, Editor, Photographer Graphic Artist Sound Technician CBT Author

Guidelines for developing materials

When developing training materials, make sure they:

- Support the objectives.
- Are student-centered.
- Meet the design that was specified in the design phase.
- Use techniques that are consistent with the principles of effective learning
- Are appealing to the students.

**Guidelines for
developing
materials
(Continued)**

Are constructed so students will be attentive. This can be done by making the material interesting and meaningful to the students.

Require the student's attention. One way to accomplish this is to require specific responses or actions.

Lead students in the direction of the behavior specified in the objective and guides them toward mastery of the task. With the proper stimuli and reinforcement, the desired student behavior can be shaped.

Are developed using experts such as programmers, photographers, graphic artists, scriptwriters, and editors in order to develop quality training materials.

Are checked for items such as technical accuracy, completeness, programming errors, or blurred slides prior to publication or production to ensure quality.

Have vocabulary at the appropriate level for the target population.

Are properly paced—not too fast or too slow.

Are easy to understand.

Include the appropriate safety precautions.

Support the human relations concepts to which the Air Force is committed.

**Additional
information**

Additional information on training development can be found in:

AFMAN 36-2234, Instructional System Development.

AFMAN 36-2236, Handbook for Air Force Instructors.

Leshin, C. B., Pollock, J. and Reigeluth, C. M. (1992).

Instructional Design Strategies and Tactics. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section C

Develop Training Alternatives

Introduction

In the design phase, training alternatives were selected to support the primary training delivery method, as applicable. If training alternatives were selected in the previous phase, the alternatives will need to be developed in this phase just as the primary training is developed.

Purpose

The purpose of developing alternative training is to ensure that there is a "back-up" system ready to support the training system by delivering critical training in the event the primary delivery system is unavailable or not usable.

Who is responsible?

Curriculum developers are responsible for developing alternative training. Managers in the training organization ensure that the necessary alternative is developed in this phase and is ready for use, if necessary, in the implementation phase.

When should the alternative be developed?

Ideally, alternative training should be developed at the same time training is developed so it is ready at training implementation. However, resources such as time, personnel, and equipment may not allow alternative training to be developed at the same time. If not, it should be developed as soon as the resources permit.

What should be done?

Curriculum developers follow the same procedures for developing alternative training as they do to develop the primary training for the system.

Section D

Install Training Information Management System

Introduction

As a curriculum developer, you may never be involved in designing or redesigning a training information management system. However, you may be involved in the installation. This section discusses the basic issues of installing a training information management system.

Who is responsible?

A project manager normally has overall responsibility for installing a new training information management system, revising an existing system, or modifying the software of an existing system. Many individuals from various training organizations will likely be involved in testing the system. For example, an instructor may be asked to update student records and a curriculum developer may be asked to update training materials in the system.

What should you look for?

If you are involved in installing or testing a training information management system there are several questions you should consider.

Is the hardware user-friendly?

Is the software user-friendly?

Are there adequate terminals for all system users to do their jobs in a timely manner?

Is the information management in your area accurate?

Is the information management in your area complete?

Is the system reliable?

Section E

Update ISD Evaluation Plan

Introduction

An evaluation plan is the "metric" or standard for evaluating the ISD process and products. It is developed initially in the planning stage and is updated in the analysis and design phases. To ensure that the ISD evaluation plan is effective throughout the life cycle of the project, you need to update it again in the development phase.

Why update the evaluation plan?

In order to have an evaluation tool that is effective throughout the life cycle of the system, you will need to keep the plan updated. It should be maintained current and accurate to reflect the actual status of the evaluation effort. Updating the plan will keep the development effort on track and ensure quality.

Who is responsible?

Curriculum developers are responsible for keeping the evaluation plan updated, while management within the training organization is responsible for ensuring that the plan is effective and that it is implemented.

Tasks involved

An ISD evaluation plan should be updated at the conclusion of each ISD phase if significant changes have occurred during the process. Updating an evaluation plan involves the following tasks.

Document changes such as:

Development products to be evaluated such as training materials, lesson plans, and ICW
Procedures for evaluating development process and products
Evaluation standards

Revise the evaluation schedule, including:

Quantity of products to be evaluated
When the development process and products will be evaluated

**Tasks involved
(Continued)**

Record development phase evaluation results.
Provide rationale for changes made to the ISD evaluation strategy during the development phase.
Document lessons learned during evaluation of the development phase.

Tracing the quality process

You should document the quality process to the point that it is traceable throughout the entire ISD process. However, document only what is necessary, and no more.

Section F

Update Training Development Plan

Introduction

The training development plan is the "blueprint" for managing the training development process. It is important for you, as a curriculum developer, to have a blueprint of how it all fits together as a training system. The plan is a valuable management tool for you, as well as for managers in the training organization.

Why update the plan?

Updating the training development plan at the end of the development phase ensures that it will remain an effective tool for managing the training system. Update the plan as necessary to reflect the most current status of training system development.

Who is responsible?

Keeping the training development plan updated is the responsibility of the curriculum developer. Training organization management has the overall responsibility for ensuring that development of the training system is documented in the plan and the plan reflects the current status.

What should be updated?

At the end of the development phase, the plan should be updated to include new or revised information, such as:

- Changes to training development strategy
- New or revised milestones resulting from the development phase
- Refinements to project definition
- Changes in resource requirements and constraints
- Deletion or addition of information resulting from the development phase

Section G

Finalize Training Materials

Introduction

After you have validated the training, you are ready to finalize the training materials. During this step, you make sure that all necessary changes are made to the training materials and they are ready for implementation.

Purpose

The purpose of finalizing training materials is to ensure that they:

- Have been revised to include the most current and accurate information
- Are complete
- Are ready for training implementation

Who is responsible?

Curriculum developers and instructors are responsible for finalizing training materials and ensuring that they are ready for implementation.

What needs to be updated?

When updating finalized training materials, you should update:

- Plans that have been developed
- Course control documents
- Training materials activity

Quality checklist

The following list of questions may help to ensure that everything is ready for implementation.

Training Development Plan

- Has the training development plan been updated?
- Is the training development plan complete?
- Has the training plan been approved?
- Has the training development plan been distributed, as required?

**Quality checklist
(Continued)****Training Standard**

Has the training standard been revised/changed?
Has the training standard revision/change been approved?
Has the training standard been published?

Course Syllabus

Has the course syllabus been updated?
Is the course syllabus complete?
Has the course syllabus been approved?
Has the course syllabus been published and distributed?

Training Materials**Print Materials**

Have the student workbooks been updated?
Are the student workbooks complete?
Have the student workbooks been published?
Have the instructor lesson plans been updated?
Are the instructor lesson plans complete?
Have the instructor lesson plans been approved and published?

Audiovisual

Have the transparencies been updated?
Are the transparencies complete?
Are the transparencies ready for use?
Have the slides been updated?
Are the slides complete?
Are the slides ready for use?

ICW

Has the program been updated?
Is the programming complete?
Has the ICW been operationally tested?

Chapter 7

IMPLEMENTATION

Overview

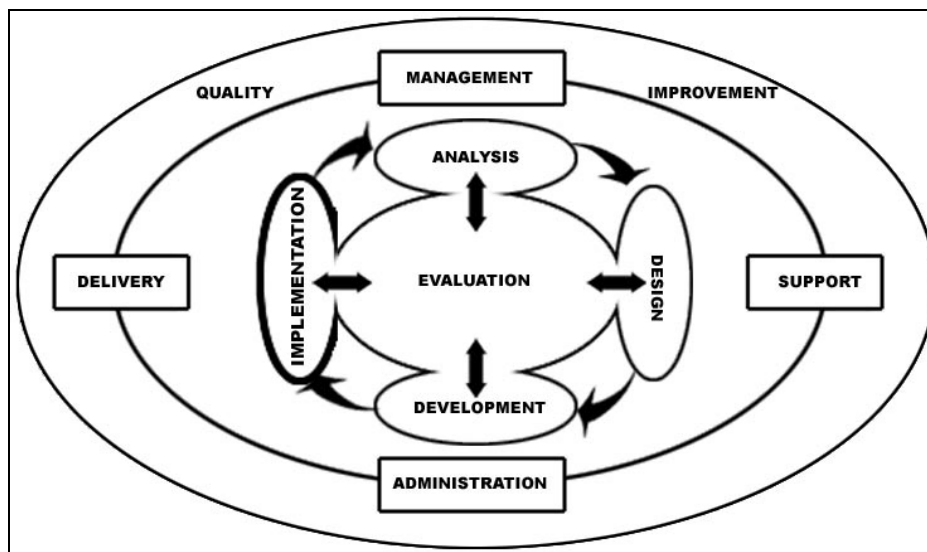
Introduction

At this point in the ISD process, the course has been validated and you are ready to implement the training. As the curriculum developer, you need to ensure that everything is ready to support implementation prior to actually implementing the training. That is, the system functions are in place, adequate resources are available, the training system itself is ready, and you are prepared to continue the evaluation process.

Where are you in the process?

An ISD model, with the implementation phase highlighted, is presented in Figure 13 to help visualize the process.

Figure 13 Implementation Phase



Objectives

The objectives of this chapter are to:

- Evaluate training system functions.
 - Develop and test final preparations for course implementation.
 - Design training implementation activities.
 - Implement an operational evaluation process.
-

**Where to read
about it**

This chapter contains four sections.

Section	Title	Page
A	Implement Training System Functions	170
B	Conduct Training	177
C	Conduct Operational Evaluation	183
D	Revise Courseware	207

Section A

Implement Training System Functions

Introduction

It is unlikely that you, as a curriculum developer, will ever be required to implement the training system functions. These functions were probably put in place when the training organization was established. Your job, along with developing training, will be to ensure that these functions are being performed and to clearly understand how the system functions interface with the training system in order to support, operate, and maintain training courses. The four system functions are management, administration, delivery, and support.

Where to read about it

This section covers four topics.

Topic	Page
Management Function	172
Support Function	173
Administration Function	175
Delivery Function	176

Additional information

For additional information on training system management functions, see:

AFMAN 36-2234, Instructional System Development, Implementation chapter.
Bills, C. B. and Butterbrodt, V. L. (1992). *Total Training Systems Design Function: A Total Quality Management Application*. Wright-Patterson AFB, Ohio.
Fishburne, R. P., Williams, K. R., Chatt, J. A., and Spears, W. D. (1987). *Design Specification Development for the C-130 Model Aircrew Training System: Phase I Report*. Williams AFB, Arizona: Air Force Human Resources Laboratory (AFHRL-TR86-44).

**Additional
information
(Continued)**

JWK International Corp. (1990). *Final Training System Baseline Analysis Report (EWOT)*. Dayton, Ohio. JWK International Corp.

Williams, K. R., Judd, W. A., Degen, T. E., Haskell, B. C., and Schutt, S. L. (1987). *Advanced Aircrew Training Systems (AATS): Functional Design Description*. Irving, Texas: Seville Training Systems (TD-87-12).

Management Function

Introduction

The **management function** is a key training system function. The management function involves managing the entire training system, including management of the training development process and the day-to-day operation of the system. It is essential that it be in place and working if the training system is to be operated effectively and adequately maintained. Lack of effective management can result in failure of the training system.

Definition

The management function is the practice of directing and controlling all aspects of the training system from initial project planning to the day-to-day operation of the system.

Who is responsible?

Organizational management has the overall responsibility for seeing that the management function is in place and carried out in support of the training system. However, some activities may be delegated to the curriculum developer.

Management activities

Activities within the training system management function are:

Planning for the design, development, delivery, support, operation, and maintenance of the training system.

Organizing resources, which includes identifying, arranging, and bringing together resources required for the training system, such as personnel, equipment, and facilities.

Coordinating activities between training and support organizations, such as civil engineering, resource management, and audiovisual services.

Evaluating the effectiveness and efficiency of each element of the project, such as personnel, budget, production, and graduates' performance.

Reporting project status to organizational management or Headquarters (HQ).

Relationship to implementation

Every aspect of the training system depends on the system management function. All of its planning, organizing, coordinating, evaluating, and reporting activities work toward successful implementation of a training program. Without this function, the system would be ineffective and inefficient.

Support Function

Introduction

The importance of the support function in the training system cannot be overstressed. In most cases, you will find that the support function already exists within the base or training organization. Although the support function may already be established, each time a training system is developed, the support requirements for that specific course must be established to ensure that adequate support is available to support the system.

Definition

The support function can be defined as those long-range as well as day-to-day tasks performed by organizations in support of the training system. Examples of support functions are:

- Maintain equipment and facilities.
- Supply materials for the courses.
- Provide services such as audiovisual or publication.

Who is responsible?

As with the other training system functions, organizational management has the overall responsibility for ensuring that the training systems within the organization are adequately supported. Curriculum developers must identify to management any lack of support for their training systems.

Examples of training support tasks

Base organizations perform many tasks in support of the training system. Examples of some of the organizations and the tasks they perform are listed below.

Civil Engineering

- Constructs training and support facilities such as classrooms.
- Modifies existing facilities, such as adding new electrical outlets, air conditioning.

Resource Management

- Provides personnel such as instructors, computer programmers, and graphic artists.
- Manages training and support equipment.
- Provides funding for day-to-day operation.

**Examples of
training support
tasks
(Continued)**

Information Management

Edits training material, such as student workbooks, student study guides.

Produces training material, such as student handbooks, course syllabuses.

Contracting or Contractor Logistic Support (CLS)

Develops contracts for maintenance and other services.

Processes local purchase forms to procure equipment, supplies.

Visual Information

Develops and controls visual material such as slides, filmstrips, video.

Manages visual equipment, such as televisions, VCRs, slide projectors.

**Relationship to
implementation**

Implementing a training system requires planning and preparation. A part of that effort is to ensure that the support functions are in place and ready to support the system. Every training system component requires some type of support or maintenance in order to effectively contribute to the training system.

Administration Function

Introduction

Often overlooked, the **administration function** plays a vital role in the day-to-day operation of a training system. You may not be directly involved in any of the administrative activities, but you should still be aware of what is being done by other organizations to support and maintain the training system.

Definition

Administration is the part of management that performs day-to-day tasks such as typing support, personnel schedules, and student records.

Who is responsible?

Organizational management has the overall responsibility for ensuring that the organization has an active administration function to support the training system. However, curriculum developers have the responsibility for ensuring that each of the courses they are responsible for receives adequate support.

Administration activities

Administration activities include items such as:

Providing documents such as course syllabuses, instructor and student materials.

Maintaining personnel, training, and equipment records.

Typing reports, letters, and messages.

Administering student support, which includes tasks such as processing student records, mailing courses to students.

Administering staff support tasks such as leave processing, preparation and maintenance of personnel records, and administration of personnel programs.

Scheduling resources such as scheduling students for classes and establishing equipment utilization schedules.

Tracking students and equipment.

Relationship to implementation

The training system administration function must be in place before you can successfully implement a training system. For example, training materials must be produced and available, reports typed, exportable courses mailed, and student records updated.

Remember, you always need administrative support for your training system.

Delivery Function

Introduction

As curriculum developers designed the training system, special care was taken to ensure that the appropriate delivery method was selected for the course. Now that the system is ready to implement, they must ensure that the delivery function is ready to support the system. The delivery function, like the other two functions that have been discussed, is also critical to the training system.

Definition

The delivery function is defined as the means or methods by which training is provided to the students. Examples of delivery include:

- Instructors
- Computers, which include ICW, CAI, or CMI
- Training devices including simulators, part-task trainers, and mock-ups
- Satellite
- Programmed text
- Exportable courses
- Job aids

Who is responsible?

Within a training organization, there are several individuals responsible for the training delivery function:

Organizational managers – responsible for ensuring adequate planning and analysis before the delivery method is selected. Once the method has been selected, management must make sure there is adequate support.

Curriculum developers – responsible for selecting the appropriate method for training delivery.

Instructors – responsible for using the selected method and evaluating the effectiveness of it.

Relationship to implementation

Simply stated, without the delivery function the training cannot be implemented. The delivery system is the vehicle for getting the training to the students.

Section B

Conduct Training

Introduction

To this point, organizational management has spent considerable time planning the training system, securing resources, managing the training development process, and arranging for system support. Curriculum developers have analyzed the tasks, designed the training system, and developed and validated the training. Now the course is ready to implement. During implementation, management continues to plan and manage the training system while the curriculum developers provide the training and continually evaluate its effectiveness.

Where to read about it

This section covers two topics.

Topic	Page
Preparations for Conducting Training	178
Conducting Training	181

Additional information

For additional information on conducting training, see AFMAN 36-2236, Handbook for Air Force Instructors.

Preparations for Conducting Training

Introduction

Although preparations for conducting training started in the initial planning and have continued throughout the analysis, design, and development phases of ISD, final preparations need to be made prior to implementing the course. Adequate preparation is essential to successful training.

Why prepare?

Adequate preparations contribute to the overall success of a training program, while inadequate preparation can result in its complete failure.

Who is responsible?

Everyone involved in the support, operation, and maintenance of a training system shares some of the responsibility for making last-minute preparation to implement the training system. For example:

Instructors must ensure that:

- Classrooms are ready.
- Training materials are available in adequate quantities.
- All equipment is available and operational.

Curriculum developers must ensure that:

- Course syllabuses are complete.
- Exportable training packages are ready.

Organizational managers must ensure that:

- Resources are available and ready for implementation (i.e., equipment, facilities, and personnel).
- Training system functions are ready to support implementation.
- Instructors have been trained and certified.

Support organization must ensure that:

- Support and services are available to support implementation of training.

When should you prepare?

Throughout this handbook, adequate planning and preparation have been a constant theme. However, at this point, the focus is on the last-minute preparations that may be required before the training is implemented. If possible, before the training is implemented, check each component of the training system to make sure everything is ready.

What should be checked?

The type of training system being implemented will determine what should be done to get ready to implement the training. For example, an exportable course will not have the same items to be checked as a course taught in a classroom environment. Some of the last-minute preparations may include checking to ensure the following:

Equipment

Training and support equipment is available in adequate numbers and in operational condition.

Equipment support, such as maintenance, is available.

Facilities

Training and support facilities are available.

Any facility modifications such as electrical and air conditioning are complete.

Is a "back-up" system available if the primary system is unavailable or not usable?

Personnel

Personnel are available, including qualified instructors, administrative and maintenance personnel.

Students have been scheduled for the classes.

Money

Adequate funds are available to meet implementation costs and the costs associated with the daily operation of the course.

Time

Curriculum developers have had adequate time to develop effective and efficient training.

Instruction has been scheduled efficiently and effectively.

**What should be
checked?
(Continued)**

Materials and Supplies

Training materials are available in adequate quantities to support training.

Training and office supplies are available in adequate quantities to support training implementation.

Conducting Training

Introduction

If adequate preparations have been made throughout the training development process and a last minute check of each training system component was made, there should be few problems, if any, encountered when implementing the training. However, conducting the training remains a critical phase of ISD.

Why conduct training?

The purpose of conducting training is to **impart** the necessary **skills, knowledge**, and **attitudes** required for the graduate to meet job performance requirements.

Who is responsible?

There are many individuals and organizations directly or indirectly involved in conducting training. Each has the responsibility for performing their respective tasks. For example:

Organizational managers have the overall responsibility for the daily operation of a training system. This responsibility includes managing the support, operation, and maintenance of the system.

Support organizations have the responsibility of providing the necessary logistic support and services to support, operate, and maintain the system.

Curriculum developers have the responsibility for designing and developing the training and continuously evaluating its effectiveness and correcting identified deficiencies, as applicable.

Conducting the training

Once the training is implemented and becomes operational, it will normally remain so until there is no longer a need for the training. When conducting training, the focus is on conducting effective and efficient training that produces graduates who can meet job performance requirements. During the operation of the training system, ongoing activities ensure system integrity, as listed below.

Resource management is probably the single most critical issue for training organization management as well as curriculum developers. Resources must be well managed to gain maximum benefit.

Staff development is an activity that goes on continually while training is being conducted. Curriculum developers as well as other training staff should periodically attend courses that help them develop professionally in curriculum development.

Conducting training is the center of system integrity. No matter what has been done to this point, the training system can fail or be rendered ineffective or inefficient if the training is not properly conducted. Some items that are helpful to remember when conducting training are:

- Training should always be student-centered.
- Training should always follow the course syllabus.
- Curriculum developers or instructors must always perform professionally in the teaching/learning environment.
- Training staff should be qualified to perform their duties.

Evaluation maintains the quality of training implementation. During the conduct of training, **operational evaluation** is continually performed to ensure the quality of a training program. It is covered in detail in the next chapter of this handbook.

Section C

Conduct Operational Evaluation

Introduction

After the formative and summative evaluations have been completed, and the system functions are in place, the instructional system is ready for implementation. Once the system is implemented and starts producing graduates, it's time to begin conducting operational evaluation. Operational evaluation is a continuous process that assesses how well course graduates are meeting the established job performance requirements.

Objectives

The objectives of this chapter are to:

- Analyze the operational evaluation process.
- Plan and execute internal evaluation.
- Plan and execute external evaluation.

Where to read about it

This section covers three topics.

Topic	Page
Operational Evaluation	184
Internal Evaluation	186
External Evaluation	193

Operational Evaluation

Introduction

Evaluation is a continuous activity that is integrated throughout each stage of ISD, beginning with analysis and continuing throughout the life cycle of the system. It focuses on quality improvement and the graduate's ability to meet job performance requirements. The last stage of the evaluation process is **operational evaluation**.

Definition

Operational evaluation is the process of gathering and analyzing internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established requirements. It is a quality improvement activity.

Purpose

The two main purposes of operational evaluation are to:

- Ensure that graduates continue to meet established job performance requirements.
- Continually improve system quality.

What should you look for?

When evaluating, look for both strengths and weaknesses in the system. Focus on:

- How well graduates are meeting job performance requirements.
- Whether unneeded training is being provided.
- Whether any needed training is not being provided.
- How well each system component is contributing to overall system quality.
- Ways to improve the graduate's performance as well as the system.

**Operational
evaluation
activities**

The two operational evaluation activities are:

Internal evaluation – gathers and analyzes internal feedback and management data from within the training environment to assess the effectiveness and quality of the training process.

External evaluation – gathers and analyzes external feedback data from the field to assess graduates' on-the-job performance in an operational environment.

**Additional
information**

For additional operational evaluation information, see:

AFMAN 36-2236, Handbook for Air Force Instructors.
Briggs, L. J. and Wager, W. W. (1981). *Handbook of
Procedures for the Design of Instruction* (2nd Ed.). Glenview,
Illinois: Harper Collins Publishers.

Internal Evaluation

Introduction

Internal evaluation activities begin with implementation of the training system and continue throughout the life cycle of the training system. Some organizations call this evaluation activity a "course review." Internal evaluations look at the instructional system from within to determine system effectiveness and quality.

Definition

Internal evaluation is the acquisition and analysis of internal feedback and management data, such as test data, student critiques, instructor comments, and data correlation from within the training system.

Purpose

The purpose of internal evaluation is to improve the effectiveness and quality of the training system.

Possible causes for problems

Although training systems are validated prior to implementation, students may still have difficulty with the training during day-to-day system operation. Possible causes of problems are:

Instructors do not follow the course syllabus.

The developed course is different from the course that is actually implemented.

Resources required to support, operate, and maintain the system are inadequate.

Training materials are not correlated.

Students do not meet course requisites.

Periodic internal evaluations will identify weaknesses (problems) as well as strengths of the training system. Internal evaluations should be conducted with sufficient frequency to ensure the quality of the training system. For example, a mature course that is seldom changed would not likely require an internal evaluation as often as a course that is constantly being updated or revised. Some training organizations conduct internal evaluations annually on all courses, regardless of their status.

Data collection

Several methods of collecting internal evaluation data are explained below.

Data Collection Methods	Purpose
Review Course Control Document	To determine if there are any discrepancies between the planned course and the course that was actually implemented.
Review Resources	To determine if resources are available and adequate: Facilities (training and support). Equipment (training, support, and test) and supplies. Personnel (curriculum developers, instructors, students). Time (course length, sufficient time to maintain course).
Visit Training Facilities	To evaluate the quality of implemented training (ensure that the visit is long enough to observe representative instruction). To check equipment, training media, training aids and devices for condition, operation, and appropriateness. To check training literature such as study guides and workbooks for quality and availability.
Evaluate Instructor Performance	To check if instructor: Follows the syllabus, uses training media properly, responds to student needs, and is qualified to teach. Noted weaknesses on the evaluation forms and if they have been corrected.
Evaluate Student Performance	To determine if students are meeting standards. To monitor flying and simulator missions.
Monitor Measurement Program	To ensure quality. To check the measurement program for compromise. If a test has been compromised, it cannot provide useful feedback. Evaluate training in terms of student performance. Use performance measures to determine students' achievement of objectives.

Conducting an internal evaluation

Collect sufficient internal evaluation data for the analysis. Insufficient data will skew the analysis results; possibly leading to incorrect decisions being made. An example of a job aid used to gather internal evaluation data is shown below.

**Conducting an
internal evaluation
(Continued)**

Check	Data Source
	Does the course syllabus reflect the operational course?
	Is the course syllabus current and accurate?
	Does the course syllabus provide adequate guidance?
	Does the lesson plan and course syllabus agree?
	Does the lesson plan reflect what is being taught in the course?
	Is the lesson plan current and accurate?
	Do training materials support the lesson plan and course syllabus?
	Do training facilities meet system requirements?
	Do support facilities meet system requirements?
	Does training equipment meet system requirements?
	Is the training equipment adequately maintained?
	Does support equipment meet system requirements?
	Are instructors teaching according to the lesson plan?
	Are instructors adequately trained?
	Do tests adequately measure the objectives?
	Is the test data thoroughly analyzed?
	Check grade sheets—are students meeting standards in the trainers (simulators, part-task)?
	Check grade sheets—are students completing all elements to stated standards?
	Are failed rides excessive?
	Can improvements be made in the course?

Student reaction

The following are examples of questions designed to obtain student feedback. A questionnaire using this information should also include a section for identification (period / date / instructor / learner) and a section for comments, explanations, or recommendations.

1. Prior to this training, my experience in this area was
_____ extensive
_____ moderate
_____ little or none
2. Did your knowledge of the subject increase as a result of the training?
_____ yes
_____ no
3. If your knowledge increased as a result of the training, to what extent did it increase?
_____ not applicable (my knowledge didn't increase)
_____ slightly
_____ moderately
_____ extremely
4. Based on my experience, the level of training was
_____ too advanced
_____ about right
_____ too elementary
5. The organization of the training was
_____ very helpful
_____ helpful
_____ not very helpful
6. The lecture outline (main points of training) was
_____ very helpful
_____ helpful
_____ not very helpful

**Student reaction
(Continued)**

-
7. Audiovisual aids were
_____ of great value
_____ valuable
_____ of little or no value
_____ not used, but could have helped
_____ not used and not needed
8. Answers to student questions were
_____ meaningful
_____ somewhat helpful
_____ not helpful
_____ not applicable (no questions asked)
9. Should the subject matter covered be changed?
_____ yes (please explain below)
_____ no
10. Should the method of training be changed?
_____ yes (please explain below)
_____ no
11. Overall, the training was
_____ outstanding
_____ good
_____ fair
_____ poor
12. Instruments (including tests) to evaluate student performance were
_____ outstanding
_____ good
_____ fair
_____ poor
-

Data analysis

Before beginning analysis of the data, ensure that:

Data has been collected from each component of the training system.

Adequate data samples are collected in order to validate the reliability of the findings.

Following are some methods of analyzing the internal evaluation data.

Compare the training standard with the course syllabus to determine if the requirements of the standard are being met. Compare course syllabus with operational course to determine if the planned and operational courses are the same.

Review course syllabus, lesson plan, and training material to determine if they are current, adequate, and in agreement.

Compare stated resource requirements with actual resources to determine if adequate resources are available to support, operate, and maintain the training system.

Review records to determine if instructors are qualified to teach the course.

Review test data to ensure that students are meeting course objectives.

Analyze test data to determine if test items are valid and reliable.

Review grade sheets to ensure that students are performing to standards (check instructor's comments).

Review failed rides report for indications of a problem and whether problem is related to academics, trainers, flying missions or the student's inability or unwillingness to complete the course. This may require an investigation of the student's grade book and interviews with instructors.

**Revising the
training system**

After internal evaluation data is collected and analyzed, the next stage is to correct deficiencies in the training system. If revisions can be made to correct identified problems, they should be made in a timely manner in order to receive the greatest benefit from the changes.

Revisions resulting from the analysis may require reentry into an earlier phase of the ISD process to correct the problem(s). The need to reenter an earlier phase of ISD is determined by the nature and scope of the revision. For example, changing a test item or adding time to a unit of training would not require reentry. However, adding a new piece of equipment to the course would more than likely require you to do so.

Section D in this chapter discusses revising courseware.

External Evaluation

Introduction

How well graduates meet job performance requirements is learned through **external evaluation**. This evaluation activity relies on input from the field to determine how well graduates are performing.

Definition

External (field) evaluation is the process of gathering and analyzing data from outside the training environment in order to determine how well recent graduates are meeting job performance requirements.

Purpose

The purpose of external evaluation is to determine if recent graduates of the course:

Can meet job performance requirements.

Need all of the training they received.

Need any training they did not receive.

Possible causes for problems

Some possible problems that may be identified during external evaluations are:

Criterion test did not measure graduates' ability to meet job performance requirements.

Objectives do not reflect job performance requirements.

Job performance requirements were incorrectly identified during task analysis.

Job performance requirements changed after task analysis.

Sequence of training did not take into account the task decay rate.

Collecting data

Several methods of collecting external evaluation are listed below.

Methods of External Evaluation	Page
Questionnaires	194
Field Visits	203
Other Sources of Evaluation Input	206

Questionnaires

Introduction

Questionnaires are effective, cost-efficient evaluation tools. The discussion on questionnaires will focus on:

- Advantages and disadvantages of questionnaires
- Types of questionnaires
- How to prepare and distribute questionnaires
- Analysis of data gathered using questionnaires

Purpose

The purpose of using questionnaires is to:

- Determine the ability of recent graduates to perform specific tasks on which they received training.
- Identify the specific nature of any deficiency.
- Determine what tasks graduates are actually performing.
- Identify what training is not needed for on-the-job performance.

Advantages

The advantages of questionnaires are:

- They are comparatively inexpensive to administer.
- They can be used to collect large samples of graduate and supervisor data.
- They yield data that can be easily tabulated and reported.
- Respondents give their opinions freely.

Disadvantages

Disadvantages of questionnaires include:

- They may not be the most reliable form of evaluation—data validity depends on preparation and distribution.
- Communication is one-way—respondent may not understand some of the questions.
- They may not ask the most relevant questions.
- They collect only opinions, which may not be as reliable as other methods of collecting external data.
- Developing effective and reliable questionnaires may be costly and require extensive experience.
- Low return rates and inappropriate responses affect accuracy.

**Types of
questionnaires**

Two types of questionnaires can be used to collect external evaluation data.

One is for the graduates' immediate supervisor. However, responding may be delegated to the graduates' trainer. The other questionnaire is for the graduates. This questionnaire is designed to find out what graduates think about the training they received.

**Preparing
questionnaires**

Well-constructed questionnaires that are properly administered are extremely important to the field evaluation process. The following table identifies the five basic stages of questionnaire development.

Stage	Activity
1	Define purpose of questionnaire. Focus only on relevant information.
2	Determine specific information to be collected. Specify exactly what is needed in a list of objectives.
3	Develop questions that ask for specific information: What conditions/equipment are required to do the job. Exact action to accomplish the performance. Standards of performance. Results of the performance.

**Preparing
questionnaires
(Continued)**

Stage	Activity
4	Consider motivational factors when developing questionnaires. You want the respondent to answer fully and conscientiously. Questionnaires will motivate if you: Explain the purpose of the questionnaire. Tell the respondents how they can benefit from answering the questionnaire. Write clear and concise instructions. Make questionnaire format uncluttered and easy to answer. For example, using boxes for check marks will make the questionnaire easier to answer. Arrange the questionnaire in logical order. Ask specific questions.
5	Test the questionnaire on sample respondents. Ask them to: Evaluate the cover letter. Check instructions and questions for clarity. Explain how they feel about answering the questions. Revise the questionnaire, if necessary, before distribution.

Note: Questions can be taken directly from the task statements in the standard.

**Guidelines for
developing
questions**

Guidelines for developing effective questions are:

Use *closed-end* questions when you want the respondent to choose answers from a small number of possibilities. This makes tabulation easy but may not give the range of answers desired.

Use *open-end* questions when you don't know all the possible answers. The respondent will probably suggest possibilities. Word questions to the respondent's level of understanding. Use vocabulary and concepts that are easy for the respondent to understand.

Limit each question to one aspect of a topic.

**Guidelines for
developing
questions
(Continued)**

Decide on the logical order of the questions (task order, general to specific). Each question increases the respondent's frame of reference and further establishes upcoming responses.

Avoid questions that make it easier to answer one way or another.

Avoid questions that show biases or exceptions.

Word questions so they will not threaten the respondents.

Supplemental "information-seeking" questions may be used.

Such questions may ask how much time the graduate spends on individual tasks or what equipment or materials the graduate uses.

**Guidelines for
constructing
questionnaires**

When constructing a questionnaire, several factors should be considered.

Provide short, concise, and specific directions for completing the questionnaire. The directions should be printed in heavy, bold type, if possible.

Provide space for the respondent's name, title, organization, and location.

Number the questionnaires to allow for administrative control.

Whenever possible, allow the respondent to use the same type marking for all questions. For example, one of the best methods is to allow use of check marks for responses.

Arrange "yes" and "no" responses vertically rather than horizontally.

Correct

Yes ____
No ____

Incorrect

Yes ____ No ____

Number each page of the questionnaire.

The questionnaire should be easy to read and mark, and should be printed.

Print on both sides of the pages to conserve materials, if possible.

- Continued on next page

Guidelines for constructing questionnaires (Continued)

Send self-addressed return envelope with the questionnaire. Fold the questionnaire in such a manner that the respondent can refold it the same way to place it in the return envelope after completion.

Guidelines for preparing cover letters

Each questionnaire should have a cover letter. The cover letter should:

Explain the purpose of the questionnaire and its importance to improving training.
Include a statement that assures the respondent that the information will be treated confidentially.
Provide information on how to return the questionnaire.
Indicate the approximate time required to complete the questionnaire.
Show the date the questionnaire was mailed and the recommended return date.
Use appropriate letterhead stationery signed by a responsible authority.

Before you distribute the questionnaire

Before distributing the questionnaire, it should be administered to a small number of select individuals to:

Provide valuable feedback on the quality of the questionnaire.
Prevent acquiring misinformation resulting from the administration of a faulty questionnaire.
Allow correction of problems in the questionnaire before distribution.

Distribution of questionnaires

Distribution of the questionnaire is a critical aspect of external evaluation. You just don't pick a few graduates' names and drop a questionnaire in the mail to them. You **plan** distribution to ensure that the data collected is valid and reliable. When distributing the questionnaire, you should:

Decide to whom you are sending the questionnaire—recent graduates, their supervisors, or both. You may collect important information from both.

**Distribution of
questionnaires
(Continued)**

Select a representative sample to ensure valid results. Graduates may perform different tasks or their job requirements may vary depending on the major command, geographic location, or organization level. Therefore, questionnaires should be distributed to each area as evenly as possible.

Decide when to distribute the questionnaires. Timing is critical. Usually, questionnaires should be sent to the graduates within three to six months after graduation. Beyond six months, it may be impossible to tell whether the graduate learned the skill or knowledge in the course or on the job. If the questionnaire is sent too early, the graduate may not have had time to perform many of the tasks that were taught in the course.

Determine how many questionnaires you need to mail out. That decision is based on:

Expected response rate.

Level of confidence (a statistical consideration which means the size of the sample required for you to be, say, 95 percent sure the sample truly represents the larger population). The graduate sampling chart on the following page shows how to determine the number of questionnaires you need based on this consideration.

Develop points of contact at the gaining units who can administer the questionnaires and ensure that they are completed and returned.

Note: To ensure that sufficient numbers of the questionnaires are returned for analysis, contact nonrespondents and encourage their response.

GRADUATE SAMPLING CHART

Course Graduates (During Sampling Period)	Sample Size 95% Confidence*	Sample Size 90% Confidence	Sample Size 80% Confidence
10	10	10	9
20	19	19	18
40	36	35	32
60	52	49	44
80	67	62	54
100	80	73	62
120	92	83	69
160	114	101	81
200	133	115	90
250	154	130	99
300	171	142	106
350	187	153	112
400	200	161	116
450	212	169	120
500	222	176	123
600	240	186	129
700	255	195	133
800	267	202	136
900	277	208	139
1,000	286	213	141
1,500	316	229	148
2,000	333	238	151
2,500	345	244	154
3,000	353	248	155
3,500	358	251	157
4,000	364	253	157
4,500	367	255	158
5,000	370	257	159
10,000	383	263	161
25,000	394	268	163
100,000	398	270	164

**Distribution of
questionnaires
(Continued)****HOW TO USE THIS TABLE**

The table can be used as shown in the following example:

Annual course production is 4,000 - 95% confidence level desired.
Estimated return rate of usable questionnaires is 85%. From the table,
364 usable questionnaires are required. Therefore, this figure should
be 85% of the questionnaires to mail out. The number of
questionnaires to mail is computed as follows:

$$\frac{85\%}{100\%} = \frac{364}{X}$$

$$X = \frac{364 \times 100}{85} = 404 = \text{number of questionnaires to mail}$$

* It is recommended that the 95% confidence level be chosen. This
is the level commonly used in business decisions.

Data analysis

When a sufficient number of completed questionnaires have been
returned, you should begin analyzing the data. In this process,
the data is:

Compiled
Collated
Analyzed (data from each command should be analyzed
together)

Pay special attention to:

Notes made by respondents on the questionnaires
Answers to supplemental questions that were included in the
questionnaire

Use with caution any data that contain such obvious errors as:

Halo effect – indiscriminate rating of all items positively
Central tendency – indiscriminate rating of items in the center
of the scale

Examine the responses to ensure, insofar as possible, that the
information accurately reflects the opinion of the graduates and
their supervisors.

Reporting findings After completing data analysis, the findings should be reported. The report should include information such as:

- Background information on the course that was evaluated
- Scope of the evaluation
- Tasks evaluated
- Analysis results
- Recommendations
- Milestones for corrective actions, if applicable

Now that the report is complete, your last action is to distribute the report.

Field Visits

Introduction

Field visits are a very effective method of conducting external evaluations. An evaluator, often assisted by a curriculum developer or instructor, normally conducts them. Ideally, field visits should include specialists who are familiar with the graduates' jobs. However, in most cases this is not possible due to limited TDY funds, scheduling constraints, and number and variety of graduates to be interviewed.

Purpose

The purpose of a field visit is to get first-hand information on the graduates' assignment, utilization, and proficiency on the job, and to validate information gained from other evaluation activities.

Advantages

Advantages of field visits are:

Guidance and information about the evaluation is given directly to graduates and supervisors.
Information is gathered first-hand by the evaluator. Any questions or assumptions can be clarified.
Field visits help validate questionnaire data.
External evaluations build rapport between the training activity and the user.
Additional information can be gained by observing nonverbal messages and asking leading or probing questions.

Disadvantages

Disadvantages of field visits are:

They are time-consuming. Travel to several different bases requires considerable time. Interviews and observations also require a lot of time if they are done correctly.
The sample is limited. Since the evaluator only visits a few bases, the number of interviews and observations conducted is limited.

**Disadvantages
(Continued)**

The cost is high. Field visits require evaluators to spend limited TDY funds to travel to the various bases.
Information gathered by the evaluator can be subjective and biased.
Graduates may feel they are being scrutinized.
Evaluators are not always skilled at interview and observation.

Data collection

Two methods of collecting data are:

Interviews
Observations

Evaluators should interview recent graduates and their supervisors and observe the graduates' on-the-job performance when possible. However, observations are almost useless unless the observer is familiar with the tasks being performed.

**Preparing for the
field visit**

Visits to the field to collect evaluation data should be adequately planned. Adequate planning will ensure that useful data is gathered. To prepare for the visit, you should:

Develop a list of questions to get honest, pertinent answers and keep the discussion focused.
Determine the bases to be visited.
Establish the schedule for the visit.
Select the individuals to be interviewed and observed.

**Conducting field
visits**

Tasks to be performed during the field visit are:

Inform graduates and supervisors of the purpose of the visit.
Tell them that their answers will furnish valuable information for improving the training.
Interview the recent graduates and their supervisors.
Supervisors should know how well the graduate has performed on the job.
Determine the graduates' proficiency.
Determine how the skills learned during training are being used.

Conducting field visits (Continued)

Find out how the graduates are progressing on OJT. Guide the interviews with your list of questions. (As the interview progresses, you may need to add, delete, or revise questions.)

Take accurate and complete notes, especially on information that is freely given.

Have the supervisor rate the graduates' performance.

Observe graduates perform tasks. This may not be possible if the evaluator does not have job or task knowledge. Take careful notes on the performance. After the task has been completed, ask questions to clarify any of the actions taken by the graduates during task performance.

Data analysis

Data collected from interviews and observations is analyzed in the same manner as questionnaires—that is, compiled, collated, and analyzed by major command or defense system.

Reporting findings

The results of the field visits and questionnaires should be combined and reported. The information gathered during field visits is not normally used or reported independently. The analysis results of the questionnaires and field visits are compared in order to validate the findings.

Other Sources of Evaluation Input

Other data sources Other external data sources that can be used to evaluate the graduates' job performance are:

Inspection team (IG) reports – AF and MAJCOMs periodically inspect instructional activities to determine their effectiveness. Other inspections conducted by these teams may also discover related problems. Use this source of data to determine if graduates are meeting their job performance requirements. Take appropriate action to correct deficiencies. One example of an IG report is the Functional Management Inspection (FMI).

Standardization/evaluation team findings – Standardization/evaluation teams periodically inspect training activities to determine their effectiveness. Analyze findings indicating a problem and take appropriate action to correct the deficiency.

Accident board reports – These reports provide data that determine cause of accidents and recommendations. Often inadequate training or conflicting data in the syllabus-related documents is identified as contributing to the cause. These reports can be included in the training program to motivate students to adopt a correct pattern or technique or discontinue an incorrect one.

Revising the training system

After the external evaluation data is collected and analyzed, the next stage is to correct the deficiencies in the training system, once the corrections have been coordinated and approved. If revisions can be made to correct identified deficiencies, they should be made in a timely manner in order to receive the greatest benefits from the changes.

The next section of this chapter discusses revising courseware.

Section D

Revise Courseware

Introduction

A major portion of the aircrew training ISD activity is the review and revision of existing courseware. The training environment is constantly changing and the courseware must be changed accordingly. In order to guard against obsolescence, it is necessary to periodically review all units of instruction and to revise the courseware as required. Through this review each phase of the ISD process is reached. Courseware revisions can be initiated at any level within the aircrew training organization.

Outcomes of courseware revisions

The outcomes of courseware revisions are numerous. For example:

- Task list and Established Training Requirements (ETRs) are brought up-to-date.

- Objectives and tests are brought up-to-date.

- Courseware control documents are updated.

- Media are updated or changed.

- Instructor guides are brought up-to-date.

- Sufficient copies of the coursebook are on inventory.

- Academics and flying squadron learning center libraries are updated.

- Total time spent in revising each unit of instruction, e.g., SME, Curriculum Development Manager (CDM), and administrative time, is reported.

- Courseware revision checklist is completed.

Change/update process

The change/update process used to revise courseware may vary depending on the nature and scope of the revision and the training organization itself. An actual change/update process used by an aircrew training organization is provided in Example 1. Another example of the change/update process is included in Example 2.

**Example 1:
Change/update
process****SME:**

Prepare course change/update using redline copy of coursebook. Start the redline copy when courseware is printed so it is available for posting when an error or typo is found by you or the students.
Initiate Courseware Revision Checklist (see page 211), recording reason for revision.
Record time spent on the revision checklist.
Plan for word processing turnaround time. Allow two weeks for initial drafting (assuming 100-page coursebook).
Complete items 2-7 of the revision checklist. Be sure to review to determine if classified material has been used anywhere in the courseware.
Prepare legible redline copy of courseware in proper format with errors and typos corrected.
Deliver redline copy to CDM and review it with CDM.
After word processing, review, proofread and edit.
Approve final product before master copy is prepared for reproduction.
Review printed copy to ensure that text and illustrations are legible.
Monitor inventory.

CDM:

Attend monthly crew specialty instructor meetings.
Coordinate with SME on all matters affecting courseware and record time spent on a Time Accounting Record Sheet.
Receive Courseware Revision Checklist and review redline copy with SME, checking format, legibility of draft, and posting of changes.
Submit request for updating graphics/photos as required.
Ensure that errors and typos are corrected and then submit to Administration for word processing using AF Form 1509, Word Processing Work Request (Appendix A).
Record date submitted and date returned on revision checklist.
Review all materials for completeness and accuracy. Record date on checklist if returned to word processing.
Have SME review, proofread, and edit as required. Record date of review on checklist, as well as date returned to word processing, if applicable.

**Example 1:
Change/update
process
(Continued)**

CDM (Continued):

Record date on checklist of decision by you and SME to accept final product.

Prepare Master copy and record date on checklist.

NOTE: Cover, illustrations, text, etc., should all be original or copy prepared by graphics or photo lab.

Prepare Printing and Collating Sequence form, and submit with master copy to ISD Tech. Record on checklist the date Master copy is sent to reproduction.

If courseware has not been delivered within two weeks, check with ISD Tech.

Ensure that copies of revised coursebook have been sent to flying squadrons for learning center library update.

Total SME time spent for the unit of instruction and report it to the Management Analysis Tech.

ISD Tech:

Review courseware to ensure that the Master copy is ready for reproduction and that the ISD process is complete.

Prepare DD Form 844, Request for Local Duplicating Service.

Pick up Master copy at pubs office and return it to the CDM.

CEM:

Randomly review courseware during the revision process.

Advise personnel in application of ISD process as required.

**Example 2:
Change/update
process**

Collect data (analysis)

Post and maintain redlined courseware.

Conduct operational evaluation of redlined courseware.

Submit formal courseware change plans (design)

Review redlined courseware.

Review operational evaluation data.

Revise courseware (development)

Modify courseware.

Review development process and products.

**Example 2:
Change/update
process
(Continued)**

Conduct training (implementation)

Implement changes in courseware.
Perform configuration activities.
Conduct operational evaluation.

**Courseware
revision checklist**

Once a revision cycle is initiated, it is suggested that a checklist be used to ensure that the revision process is effectively managed. An actual courseware revision checklist is provided on the following pages as an example.

COURSEWARE REVISION CHECKLIST		OPR D05C	Date		
#	Item		YES	NO	NA
1.	Reason for revision a. Inventory depleted, date _____ b. Technical Order, name _____ change # _____ c. Regulation, name _____ replaced by _____ d. Manual, name _____ replaced by _____ e. Other (specify) _____				
	SME notify CDM of change and reason. Date CDM notified _____				
	Has SME completed items 2-7 of this checklist insuring that changed material is drafted into a red line copy of courseware?				
	Date materials sent to CDM for review and word processing. 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____				
	Date materials sent by CDM to word processing. 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____				
	Date materials return from word processing. 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____				

COURSEWARE REVISION CHECKLIST (Continued)		OPR D05C	Date		
#	Item		YES	NO	NA
	<p>Materials review for completeness of word processing and returned to:</p> <p>a. D05 CDM for completeness and accuracy</p> <p>1. _____ 2. _____ 3. _____</p> <p>4. _____ 5. _____ 6. _____</p> <p>b. SME for review, proofreading, and editing.</p> <p>1. _____ 2. _____ 3. _____</p> <p>4. _____ 5. _____ 6. _____</p>				
	<p>Date of decision on final product. _____ SMS _____ CDM _____</p> <p>Date Master created. _____</p> <p>Date materials sent to reproduction. _____</p>				
2.	Courseware review				
	Is all changed/corrected material included, ERRATA, date changes?				
	Does Table of Contents agree with the lesson codes, titles, and page #'s?				
	Do the materials for a specific lesson meet the objective(s)?				
	Do the sample Criterion Test items reflect the criterion test question type?				
	Are the lesson procedures correct?				
	Are all required lesson resources listed?				
	Are all exercise items referenced?				
	Are there sufficient instructions to complete the exercises?				
	Are the answers to the exercises included in the coursebook?				
	Are there enough answer blocks/blanks and can they contain a write-in answer?				
	Is the revised material complete and accurate?				

COURSEWARE REVISION CHECKLIST (Continued)		OPR D05C	Date		
#	Item		YES	NO	NA
	Note: Be sure to review to determine if classified material has been used anywhere in the courseware.				
3.	Education/Training Requirements review				
	Have necessary changes/additions been made?				
	Do the objectives in the course book and on ETR pages read word-for-word the same?				
4.	Media review				
	Have the required changes been made to scripts?				
	Have arrangements been made to create or change tape/slide packages?				
	Have instructions been given for use of tapes with out-of-date materials?				
5.	Criterion Tests review				
	Are any test items to be changed?				
	Are the test instructions complete and correct?				
	Are the answer keys correct and properly referenced?				
6.	Instructor guide review				
	Is any material to be changed?				
	Are the objectives, lesson procedures, and resources listed and do they agree with the coursebook(s)?				
	Is there a separate page for each lesson start?				
7. a.	Rechecked contents for classified materials? Name _____ Date _____				
	b. SME log time spent in revising this courseware (see item 10).				
8.	CDM Master Construction				
	Is the date and title on the cover correct?				
	Is the utilization letter current?				
	Are correct symbols used for the lesson identifier on the title page?				
	Does each lesson start on an odd-numbered page?				
	Has a printing and collating sequence sheet been made up?				

COURSEWARE REVISION CHECKLIST (Continued)		OPR D05C		Date		
#	Item	YES	NO	NA		
9. General						
Were two copies of the latest academic coursebooks sent to the flying squadrons to maintain their learning center library? (CDM)						
SUMMARY OF CHANGES:						
10. Cost Accounting: SME indicate time to nearest tenth (.10) of an hour spent revising the unit of instruction. Label time by grade (O- /E-) and process such as writing, reviewing/editing, graphics and reproduction.						
Pay Grade	Writing	Editing	Graphics	Reproduction	Other	

Chapter 8

EVALUATION

Overview

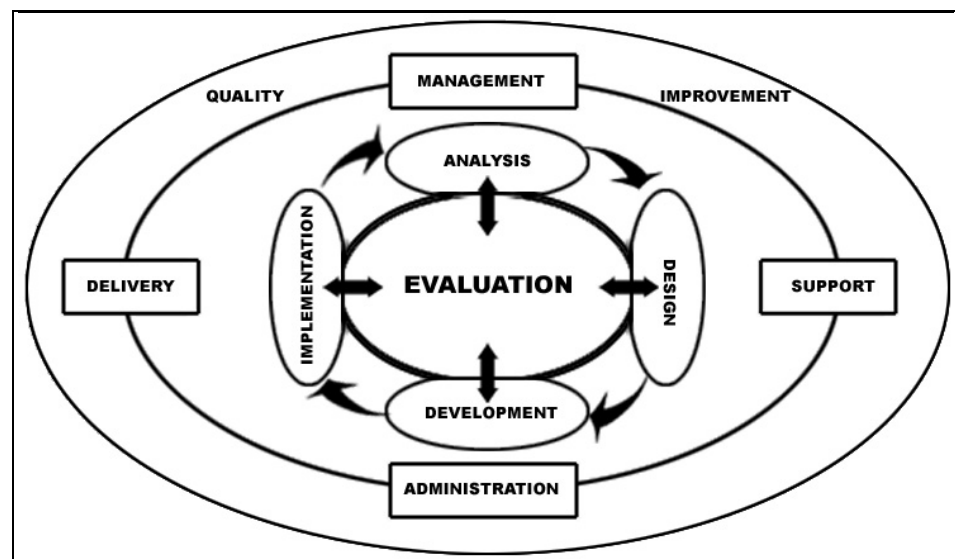
Introduction

Evaluation is integrated throughout each activity of the instructional development process. It starts in the planning stage with development of an evaluation plan and continues through the life cycle of the training system. The focus of evaluation is continuous improvement in training system quality. This chapter stresses the importance of the evaluation process by summarizing the evaluation activities discussed in earlier chapters of this handbook. For example, formative and summative evaluations are discussed in Chapter 6 and operational evaluation is described in Chapter 7.

Where are you in the process?

The ISD model, with the evaluation phase highlighted, is depicted in Figure 14. As depicted in the model, each stage in the ISD process involves evaluation activities.

Figure 14 Evaluation



Objective

The objective of this chapter is to summarize a:

- Formative evaluation
- Summative evaluation
- Operational evaluation
- Validate Training

**Continuous
evaluation process**

As previously mentioned, evaluation is an ongoing process. It begins during ISD planning and continues as long as the instructional system is operational. The process includes formative, summative, and operational evaluations. Each of these forms of evaluation is discussed in subsequent sections of this chapter. A brief overview of the evaluation process is provided in the following table in order to acquaint the user of this handbook with the continuous evaluation process.

Continuous Evaluation Process		
Form	Period	Purpose
Formative	From initial ISD planning through small-group tryout	Checks design of individual components of the instructional system for integration (accomplished periodically – is focused on the components – high data collection – make changes when it is least expensive to revise).
Summative	Operational tryout (normally 2 or 3 classes) – real student throughput, full instructional system operation	Checks full system integration and its components (intense – high data collection – short-term – first time everything is working together).
Operational	From completion of the operational tryout continuing for the life cycle of the instructional system	Checks day-to-day system integration and its components (periodic, less data collection, life of system – continuous improvement).

**Where to read
about it**

This chapter contains four sections.

Section	Title	Page
A	Validate Training	218
B	Formative Evaluation	230
C	Summative Evaluation	234
D	Operational Evaluation	235

**Additional
information**

For additional information on evaluation, see:

Previous chapters in this handbook.

AFMAN 36-2236, Handbook for Air Force Instructors.

Briggs, L. J. and Wager, W. W. (1981). *Handbook of Procedures for the Design of Instruction* (2nd Ed.). Glenview, Illinois: Harper Collins Publishers.

Dick, W. and Carey, L. (1990). *The Systematic Design of Instruction*. (3rd Ed.). Glenview, Illinois: Harper Collins Publishers.

O'Neil, H.F. Jr., and Baker, E.L. (1991). Issues in Intelligent Computer-Assisted Instruction: Evaluation and Measurement. In T. Gutkin and S. Wise, (Eds.) *The Computer and the Decision Making Process*. Hillsdale, New Jersey: Laurence Erlbaum Associates.

Section A

Validate Training

Introduction

ISD is more an art than a science. It offers no fixed formulas that guarantee outcomes, only guidelines. Validation is a quality improvement tool that helps identify problems in the training during development so that revisions can be made. Validation consists of internal reviews, individual tryouts, and small-group tryouts, which are conducted as a part of **formative evaluation** and operational (field) tryouts, which make up **summative evaluation**.

What is validation?

Validation is a process that assesses the effectiveness of the training as it is being developed with the intention of improving the training product. It is a process of repetitive cycles of development, tryouts, and revisions until evidence shows that the training is effective.

When should you validate?

It is important that validation be conducted during – not after – training development and should be part of the total development plan developed during the management phase. The purpose is to correct all mistakes or problems before you spend too many resources on a flawed product. Validation should be done as segments, units, or blocks of training are being developed.

Where to read about it

This section covers five topics.

Topic	Page
Plan Validation	219
Conduct Internal Reviews	220
Conduct Individual Tryouts	223
Conduct Small-Group Tryouts	226
Conduct Operational (Field) Tryouts	228

Plan Validation

Introduction

Planning is a key factor in developing a training system. Without adequate planning and preparation, it is unlikely that the training system would effectively and efficiently produce graduates who have the skills, knowledge, and attitudes to perform the job under operational conditions. A part of that necessary planning is how you intend to validate training as it is developed.

Purpose

As with any other plan, a validation plan provides curriculum developers and instructors with a roadmap for validating the training. A validation plan adds structure and creditability to the validation process.

Who is responsible?

Planning validation is the responsibility of the curriculum developer. In some cases, this responsibility may be delegated to other individuals, such as an instructor. Managers in the training organization have overall responsibility for ensuring that the validation process is adequately planned for the training system being developed. The validation plan is included as part of the ISD evaluation plan.

What is in a validation plan?

Validation plans may contain the following information:

- Description of the training to be validated (objectives, method, media)
- Validators or measures of validation
- Validation procedures
- Validation schedules
- Number of tryouts to be conducted
- Number of students to be used in the small-group and field tryouts
- Sources and how the results will be documented
- How problems will be resolved

Remember, include only necessary information in the validation plan and keep it simple.

Conduct Internal Reviews

Introduction

The first step in the validation process is internal reviews, which is a formative evaluation activity. These reviews identify technical inaccuracies and instructional weaknesses in the training. Qualified individuals from within the training organization normally conduct the review before a selected target population tries out the training.

Purpose

The purpose of internal reviews is to verify the accuracy of the training materials that have been developed by cross-checking them against data sources such as technical orders, checklists, and job aids.

Who should review?

The following individuals perform internal reviews:

SMEs make sure the content is technically accurate and the coverage is adequate.

Curriculum developers make sure the material follows sound instructional principles and the training method, medium, and activities used are appropriate to the content and specified target population.

What should be reviewed?

Training materials should be submitted for review as they are developed. If several different authors created the lessons for a unit, the draft materials for the entire unit should be reviewed as a unit before any media are created. Materials to be validated for each type of media are listed below.

**What should be reviewed?
(Continued)**

Type of Media	Materials to be Validated
Print-based materials (workbooks, handouts, training manuals) Classroom training	List of objectives Test items Draft of printed materials List of objectives Test items Plans of instruction Drafts of support materials (transparencies/slides)
Traditional audiovisual materials (videotapes, film slide) Interactive courseware (IVD, CMI)	List of objectives Test items Storyboard/script List of objectives Test items Storyboard/script Graphics/video produced Screens developed

During a review

During an internal review, you should:

Cross-check technical data for agreement and concurrency.
Use a focus group (SME, supervisors, instructor, and curriculum developer) to review the training material.

**During a review
(Continued)****Questions You May Ask During Internal Reviews**

1. Is the content of the training materials accurate?
2. Is the training material current?
3. Is the training material complete?
4. What are the "good" parts of the training?
5. What are the "bad" parts of the training?
6. Is the sequence of the material effective?
7. Are the practice exercises adequate?
8. Are the review exercises adequate?
9. Do the training materials/lessons effectively teach the behavior specified in the objective?
10. Is the objective adequately evaluated?
11. Is the content of the training materials compatible?
12. Can the training materials be improved? If so, how?

**Common problems
identified**

Some of the common problems that you may identify during the internal reviews are:

- Lack of agreement in the material
- Inaccuracies in the material
- Incomplete material
- Weaknesses in the material
- Lack of continuity in the material

After a review

Upon completion of the internal reviews, you should:

- Determine the changes to be made to improve the training materials.
- Decide the best way to make the changes to the training materials.
- Make the changes to the training materials, as applicable.

Conduct Individual Tryouts

Introduction

During the **individual tryouts**, which are a formative evaluation activity, a curriculum developer tests the training materials on individual students. Several students should be used for comparison in order to obtain more valid and reliable results.

Purpose

The purpose of individual (one-on-one) tryouts is to determine the effectiveness of small segments or units of training and materials as they are developed.

Select students for tryouts

When selecting students for individual tryouts, consider these issues.

Students selected should represent the target population in:

- Aptitude
- Skills
- Attitude
- Prior knowledge
- Background experience

Select students for the first tryouts from the upper percentage ranges in aptitude and background. The reasons for selecting students from the upper-percent level for the first tryout are:

- Above-average students often point out and analyze weaknesses in the training or training materials.
- If better students cannot learn the material, less capable students will not be able to.
- If lower-level students are used in the individual test and they do well, it will be hard to assess the relative difficulty of the lesson.
- It is easier to add material in order to make a lesson easier and more effective than to identify and delete existing material that is unnecessary or confusing in order to achieve the optimum level and quality of instruction.

Before a tryout

Before conducting individual tryouts, a curriculum developer should prepare the students for the tryout. Students need to know:

- Purpose of the tryout.
- Their role in the tryout.
- That they are not being evaluated—the training is.
- That their active participation is essential if the tryout is to be successful.
- That their feedback is necessary to determine adequacy of the training material.

If instructors are involved in the individual tryouts, they should be made aware of their role and the role of the student.

During a tryout

During the individual tryouts, a curriculum developer should:

- Use a pretest to identify entry behavior.
 - Use a post-test to assess learning as a result of the tryout.
 - Observe where each student seems to have problems or uncertainties.
 - Give assistance only when essential to the student's progress.
 - Determine which exercises or tasks result in errors; type of errors; how many students make the same error(s).
 - Get each student's view about the difficulties encountered during the tryout.
 - Ask each student for suggestions on how to improve the training.
-

Common problems identified

Some of the common problems that you may identify during individual tryouts are:

- Improper sequencing of the training
 - Gaps in the training
 - Inadequate explanation of content
 - Wrong assumption about target population's prerequisite knowledge
 - Confusing test items
 - Test items that do not measure objectives
 - Insufficient practice time
-

After a tryout

After individual tryouts, analyze the data to determine if there are error patterns or problems. If so, change or revise the training or training material as appropriate.

If the training or materials require significant changes, it would be wise to conduct additional tryouts to make sure that changes made were effective in solving the problem.

Conduct Small-Group Tryouts

Introduction

Up to this point, the success of the training has been based on a limited sampling of students of higher aptitudes. Since training is developed for average students, small-group tryouts that focus on an average group of students are required. Small-group tryouts conclude the formative evaluation process.

Purpose

The purpose of conducting small-group tryouts is to determine if the training works for the average target students.

Select students

Students selected to participate in the tryouts should be representative of the target population. If possible, they should have:

- Even distribution between low and high aptitudes
- Varying skill levels
- Backgrounds that are representative of the target population

The number of students in the small groups is determined by several factors, such as:

- Actual task requirements (for example, some tasks may require students to work in teams of two; if so, the small-group size should be a multiple of two)
 - Planned group size of the actual course
 - Availability of equipment
 - Availability of facilities
-

Time is critical factor

During small-group tryouts, students should be given a reasonable amount of time to learn, practice, and perform the skills trained. The average time required by the groups will help establish the time to be allotted in the course for that unit of training.

Before a small-group tryout

Before a small group tryout, you should:

Determine the number and availability of students and groups to be used in the tryouts.

Select representative students from the target population.

Ensure that training has been revised in accordance with results from individual tryouts.

Ensure that student materials are available in adequate quantities.

Establish the number of trials a student will be permitted to achieve the criterion performance.

During a tryout

During a small-group tryout, you should:

Record the time each student takes to complete the material.

This information will be used to validate unit time, course lengths, and course content.

Record student responses. This information will help determine the weaknesses of the training.

Don't supplement the training. Supplementing the training will skew the results of the tryout.

After a tryout

After a tryout, you should analyze the results to:

Identify the average completion time for each segment or unit of training. This information determines the exact time for lessons, segments, units, or modules of training.

Determine the need to revise equipment requirements, change the facilities and adjust the personnel authorizations.

Revise the training and materials.

If the training requires significant changes, it may be necessary to conduct additional tryouts to determine if the revisions will be effective.

Conduct Operational (Field) Tryouts

Introduction

The final stage of validation is operational (field) tryouts, which comprise the summative evaluation process. Field tryouts provide a learning situation that is intended for the training materials. All of the materials and media should be complete and ready to go. For example, if it is classroom training, an instructor should be used to teach the class. If it is CBT, the students should sit at the computer and interact with the program.

Purpose

Field tryouts serve several purposes:

They determine if the training actually works under operational conditions.

They provide feedback from a large sample of the target population for final revisions or refinements of the training.

They identify implementation problems, such as equipment and facilities.

Select students

For field tryouts, students are assigned to the tryout group using the normal class assignment procedures.

Before a tryout

Before a field tryout, make sure that:

Resources are available, such as equipment, facilities, and instructors.

Training has been revised based on the results of small-group tryouts.

Training materials are available in adequate quantities.

Students have been scheduled and informed of the purpose of the tryout.

During a tryout

In many respects, a field tryout is like the normal day-to-day operation of a training course. During a field tryout, you should:

Ensure that the training is conducted under normal operating environment.

Collect validation data such as time requirements, measurement results, instructor and student comments, and problem areas.

Use adequate class samples to ensure that the data is both valid and reliable.

Data collection

During an operational tryout, you may collect data from students before, during, and after the training. The field data collection is summarized.

Stage	Data To Be Collected	Data Collection Methods
Before	Student entry skill/knowledge level	Pretest Oral examination Student interviews
During	Number of errors students make Questions raised by students Student work samples Duration of the training	Observations Recording student questions Collecting work samples
After	Student learning gains Student views about the training	Post-test Student interviews Student critiques

After a tryout

After a field tryout, you should:

Analyze the data gathered during the tryouts.

Revise the training and materials as necessary.

Section B

Formative Evaluation

Introduction

The **formative evaluation** process begins during analysis and continues through small-group tryouts in the development stage of ISD. Within each stage—analysis, design, and development—formative evaluation seeks to improve the quality of the ISD activities (process) and products. In some organizations, formative evaluation is equated to four stages of validation: internal reviews, individual tryouts, small-group tryouts, and operational tryouts.

Definition

Formative evaluation is designed to collect data and information that is used to improve the ISD activities and products while the system is still being developed.

Formative evaluation activities

Formative evaluation includes the following activities.

Process Evaluation

Process evaluation ensures quality in the analysis, design, and development activities. It checks each activity against the standards or metrics established during ISD project planning, to assure process quality, while continually seeking improvements within each activity. Process evaluation enables curriculum developers to form an effective and efficient training system based on quality principles.

Product Evaluation

Product evaluation is an integral part of each stage of ISD. Product evaluation focuses on the products of the analysis, design and development activities such as task lists, objectives, tests, plans of instruction and training materials. During product evaluation the focus is again on quality. Products are measured against established standards or metrics to ensure quality. Product evaluation also helps form a total quality training system.

**Formative
evaluation
activities
(Continued)**

Two activities of product evaluation are:

Validation, which takes place during training development and is the final activity in the formation evaluation process. This component forms the training system by trying out instruction on individuals and small groups. Validation identifies quality improvements that should be made to the training prior to implementation.

Quality control starts in the initial stages of ISD planning, with the strategy for controlling quality, and continues throughout training analysis, design and development. This process ensures that each activity, such as equipment acquisition and facility construction, is based on quality principles.

Development Test and Evaluation (DT&E)

DT&E is an active part of training system development. As a formative evaluation activity, it is conducted to demonstrate that training system equipment design and development is complete, design risks have been minimized, and the system meets performance requirements. It ensures the effectiveness of the manufacturing process, equipment, and procedures.

Operational Test and Evaluation (OT&E)

OT&E completes the formative evaluation process for training system equipment. This formative evaluation activity evaluates the system's operational effectiveness, maintainability, supportability, and suitability to identify any operational and logistic support deficiencies, and to identify the need for modification. In addition, OT&E provides information on organizational structure, personnel requirements, support equipment, doctrine, training, and tactics. It should also provide data to verify operating instructions, maintenance procedures, training programs, publications, and handbooks.

Site Readiness Reviews

The site readiness review is a formative evaluation activity that focuses on evaluating readiness of the "bed-down" site for the training system. This evaluation ensures that the site, including training facilities and support equipment, is ready for OT&E of the system. Site readiness reviews ensure successful training system implementation.

Relationship of the activities

Formative evaluation activities contribute to the overall quality of the training system. They combine to ensure that:

Training development activities are effective and cost-efficient.
Products of each development activity meet quality standards.
Training meets requirements.
Equipment satisfies operational, training, and support requirements.
Facilities meet operational, training, and support requirements.

Period of formative evaluation

Planning for formative evaluation begins in the initial planning stage of ISD, with evaluation activities actually beginning during analysis and continuing through small-group tryout in development.

Section C

Summative Evaluation

Introduction

With the conclusion of small-group tryouts, formative evaluation activities are complete. **Summative evaluation** is the next stage in the continuous evaluation process. This stage of evaluation involves trying out the training on the target population in an operational environment. In some organizations, summative evaluations are conducted after the instructional system becomes operational. Summative evaluation includes two components: internal and external evaluation.

Definition

Summative evaluation is designed to collect data and information during the operational (field) tryouts in order to determine the "summed" effect of the training under operational conditions.

Summative evaluation activity

The only activity within summative evaluation is the operational tryouts. Operational tryouts:

- Determine if the instructional system works under operational conditions.

- Provide feedback from a large sample of target population in which to base revisions prior to implementation of the training system.

- Identify possible implementation or operational problems.

Evaluating the integrated system

Summative evaluations are conducted on fully integrated training systems—that is, each component of the system is functioning as a whole. This form of evaluation is essential in determining the effectiveness of the system and correcting any deficiencies prior to implementation.

Period of summative evaluation

Summative evaluation is focused on the period of operational tryouts. These tryouts begin after the small-group tryouts have been completed and continue until the training system is implemented. Normally, the operational tryout period is limited to two or three classes.

Section D

Operational Evaluation

Introduction

As previously mentioned, the evaluation process is continuous. Once formative and summative evaluation activities have been completed and the training system is implemented, **operational evaluation** begins. Operational evaluations continue as long as the system is operational. In some organizations, this form of evaluation is called summative evaluation.

Definition

Operational evaluation is designed to gather and analyze internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established training requirements.

Operational evaluation activities

Operational evaluation activities include internal and external evaluation.

Internal Evaluation

Internal evaluation focuses on evaluating the training system internally. This form of evaluation continuously evaluates feedback data, such as instructor comments, students' critiques and test results, in order to continuously improve the system and ensure quality.

External Evaluation

External evaluation focuses on evaluating the training system externally. This form of evaluation continuously evaluates feedback data from the field, such as inspection and evaluation reports, to ensure that graduates meet the established job performance requirements.

Relationship of activities

Each operational evaluation activity contributes to the overall quality of the training system by ensuring that:

Each system component continues to contribute to the overall effectiveness and cost-efficiency of the system.
Graduates of the course continue to meet established job performance requirements.

**Period of
operational
evaluation**

Operational evaluation begins with implementation of the training system and continues for the life cycle of the system. A schedule of review should be established for all training materials and be included in the ISD evaluation plan. Courseware review boards, with all relevant people in attendance, can also be an effective way of evaluating the program.

RICHARD E. BROWN, Lt General, USAF
DCS/Personnel

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

AFPD 36-22	Military Training
AFI 36-2201	Developing, Managing and Conducting Military Training
AFI 36-2301	Professional Military Education
AFMAN 36-2234	Instructional System Development
AFMAN 36-2236	Handbook for Air Force Instructors
AFH 36-2235	Information for Designers of Instructional Systems (12 Volumes)
Vol 1	ISD Executive Summary for Commanders and Managers
Vol 2	ISD Automated Tools/What Works
Vol 3	Application to Acquisition
Vol 4	Manager's Guide to New Education and Training Technologies
Vol 5	Advanced Distributed Learning: Instructional Technology and Distance Learning
Vol 6	Guide to Needs Assessment
Vol 7	Design Guide for Device-based Aircrew Training
Vol 8	Application to Aircrew Training
Vol 9	Application to Technical Training
Vol 10	Application to Education
Vol 11	Application to Unit Training
Vol 12	Test and Measurement Handbook

Walter Dick, Lou Carey, James O. Carey (2000). *The Systematic Design of Instruction 5th Edition*. Addison-Wesley Pub Co. ISBN 0321037804.

Patricia Smith & Tillman Ragan (1999). *Instructional Design, 2nd Edition*. John Wiley & Sons, 399 pages. ISBN 047136570X.

Ruth Clark (1999). *Developing Technical Training 2nd Edition: A Structured Approach for Developing Classroom and Computer-based Instructional Materials*. International Society for Performance Improvement. 238 pages. ISBN 1-890289-C7-8

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M. David Merrill, Robert D. Tennyson, and Larry O. Possey (1992). *Teaching Concepts: An Instructional Design Guide 2nd Edition*. Educational Technology Pub. ISBN 0-87778-247-4

Robert M. Gagné, Leslie J. Briggs, and Walter W. Wager. (1992). *Principles of Instructional Design 4th Edition*. Wadsworth Pub. Co. 365 pages. ISBN 00300347572

Robert M. Gagné (1985). *The Conditions of Learning and Theory of Instruction 4th Edition*. Holt, Rinehart and Winston. ISBN 0-03-063688-4

Jeroen J. G. van Merriënboer (1997). *Training Complex Cognitive Skills*. Educational Technology Publications.

Ruth Clark (1998). *Building Expertise: Cognitive Methods for Training and Performance Improvement*. International Society for Performance Improvement. 204 pages. ISBN 1890289043.

Bernice McCarthy (1996). *About Learning*. Excel, Inc. 452 pages. ISBN 0-9608992-9-4

Malcolm Fleming & W. Howard Levie (Editors) (1993). *Instructional Message Design: Principles from the Behavioral and Cognitive Sciences 2nd Edition*. Educational Technology Publications. 331 pages. ISBN 0-87778-253-9.

Ellen D. Gagné, Frank R. Yekovich, and Carol Walker Yekovich (1993). *The Cognitive Psychology of School Learning. 2nd Edition*. Addison Wesley Longman, Inc. 512 pages. ISBN 0673464164.

Marcy P. Driscoll (1999). *Psychology of Learning for Instruction 2nd Edition*. Allyn & Bacon. 448 pages. ISBN 0205263216

Ann E. Barron & Gary W. Orwig (1997). *New Technologies for Education: A Beginner's Guide 3rd Edition*. Libraries Unlimited. ISBN 1563084775

Robert Heinich & Michael Molenda (1998). *Instructional Media and Technologies for Learning 6th Edition*. Prentice Hall. 428 pages. ISBN 0138591598.

Diana Laurillard (1993). *Rethinking University Teaching: A Framework for the Effective Use of Educational Technology*. Routledge. ISBN 0415092892.

Tom Boyle and Tim Boyle (1996). *Design for Multimedia Learning*. Prentice Hall. 275 pages. ISBN 0132422158.

William W. Lee and Diana L. Owens (2000). *Multimedia-Based Instructional Design: Computer-Based Training, Web-Based Training, and Distance Learning*. Jossey-Bass. 304 pages. ISBN 0787951595.

Margaret Driscoll & Larry Alexander (Editor) (1998). *Web-Based Training: Using Technology to Design Adult Learning Experiences*. Jossey-Bass Inc. 288 pages. ISBN 0787942030.

Brandon Hall (1997). *The Web-Based Training Cookbook*. John Wiley & Sons. 496 pages. ISBN 0471180211.

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ACRONYMS AND ABBREVIATIONS

AATS	Advanced Aircrew Training Systems
A/C	Aircraft
ACC	Air Combat Command
ADI	Attitude Direction Indicator
AETC	Air Education and Training Command
AF	Air Force
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPAM	Air Force Pamphlet
AFPD	Air Force Policy Directive
AFS	Air Force Specialty
AFSC	Air Force Specialty Code
CAI	Computer-Assisted Instruction
CBI	Computer-Based Instruction
CBT	Computer-Based Training
CDM	Curriculum Development Manager
CLS	Contractor Logistic Support
CMI	Computer-Managed Instruction
CRO	Criterion-Referenced Objective
DoD	Department of Defense
DT&E	Development Test and Evaluation
ETR	Established Training Requirements
FEB	Flying Evaluation Board
FMI	Functional Management Inspection
HQ	Headquarters
HSI	Heading Situation Indicator
HUD	Heads Up Display
IAW	In Accordance With
ICW	Interactive Courseware
IFR	Instrument Flight Rules
IG	Inspector General
ISD	Instructional System Development
JPR	Job Performance Requirements
KTAS	Knots True Air Speed
LP	Lesson Plan
MAJCOM	Major Command
MCP	Military Construction Project
OFT	Operational Flight Trainer
OJT	On-the-Job Training
OMS	Occupational Measurement Squadron
OPR	Office of Primary Responsibility
OSR	Occupational Survey Report
OT&E	Operational Test and Evaluation

PAS	Primary Alerting System
POI	Plan of Instruction
QAF	Quality Air Force
QI	Quality Improvement
SKA	Skill, Knowledge and Attitude
SME	Subject Matter Expert
SMS	Subject Matter Specialist
SPO	System Program Office
STP	System Training Plan
TDW	Task Description Worksheet
TDY	Temporary Duty
TNA	Training Needs Assessment
TO	Technical Order
TPR	Trained Personnel Requirement
TPT	Training Planning Team
USAF	United States Air Force
VCR	Video Cassette Recorder
VFR	Visual Flight Rules

TERMS

The following list of definitions includes those terms commonly used in aircrew training as it relates to instructional system development and as used in this handbook. The list is not to be considered all-inclusive.

Acquisition. The procurement by contract, with appropriated funds, of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated.

Aircrew Training System (ATS). A contractor produced, operated and maintained ground-based system used to train aircrew members. It includes training equipment, software, firmware, hardware, devices, courseware, training system support, logistics support, ground-based instruction, media, and facilities. It typically does not include flight training or aircraft support.

Association. The connection made between an input (stimulus) and an action (response).

Attitude. (a) The emotions or feelings that influence a learner's desire or choice to perform a particular task. (b) A positive alteration in personal and professional beliefs, values, and feelings that will enable the learner to use skills and knowledge to implement positive change in the work environment. Also see **Knowledge** and **Skill**.

Audiovisual Medium. Any delivery device or system which provides both audio and visual presentations.

Behavior. Any activity, overt or covert, capable of being measured.

Cognition. The mental or intellectual activity or process of knowing, includes both awareness and judgment.

Cognitive Strategies. The capability of individuals to govern their own learning, remembering, and thinking behavior.

Computer-Assisted Instruction (CAI). The use of computers to aid in the delivery of instruction. A variety of interactive instructional modes are used including tutorial, drill, and practice, gaming, simulations, or combinations. CAI is an integral part of computer-based instruction (CBI) and computer-based training (CBT).

Computer-Based Instruction (CBI) and Computer-Based Training (CBT). The use of computers to aid in the delivery and management of instruction. CBI and CBT are synonymous and are used interchangeably. CAI (the delivery of instruction) and CMI (computer-managed instruction) are both elements of CBI and CBT.

Computer-Managed Instruction (CMI). The use of computers to manage the instructional process in CAI or CBT. Management normally includes functions such as registration, pretesting, diagnostic counseling, progress testing, and post-testing. CMI is also used to schedule and manage training resources such as trainers and actual equipment.

Constraints. Limiting or constraining conditions or factors, such as policy considerations, time limitations, equipment, environmental factors, personnel, budgetary, or other resource limitations.

Contract Logistics Support (CLS). A preplanned method used to provide all or part of the logistics support to a system, subsystem, modification, or equipment throughout its life cycle. CLS covers depot maintenance and, as negotiated with the operating command, necessary organizational and intermediate (O&I) level maintenance, software support, and other operation and maintenance (O&M) tasks.

Contractor. An individual or organization outside the Government that has accepted any type of agreement or order for providing research, supplies, or services to a Government agency.

Course Chart. A qualitative course control document that states the course identity, length, and security classification, lists major items of training equipment, and summarizes the subject matter covered.

Course Control Documents. Specialized publications used to control the quality of the instructional system. Examples are training standards, plans of instruction, syllabi, and course charts.

Courseware. Training materials such as technical data, textual materials, audiovisual instructional materials, and computer-based instructional materials.

Criterion. (a) The standard by which something is measured. (b) In test validation, the standard against which test instruments are correlated to indicate that accuracy with which they predict human performance in some specified area. (c) In evaluation, the measure used to determine the adequacy of a product, process, behavior, and other conditions.

Criterion-Referenced Objective (CRO). (a) A performance-oriented tool identifying criteria and actions required to demonstrate mastery of a task. (b) An objective with prescribed levels of performance. Each CRO contains a behavior (task statement), a condition (available equipment, checklists, and governing directives, or the situation requiring the task), and a standard (regulation, operating instruction) for the task.

Criterion-Referenced Test (CRT). A test to determine, as objectively as possible, a student's achievement in relation to a standard based on criterion objectives. During instructional development, the CRT can be used to measure the effectiveness of the

instructional system. The test may involve multiple-choice items, fill-in items, essays, or actual performance of a task. If given immediately after the learning sequence, it is an acquisition test; if given considerably later, it is a retention test; if it requires performance not specifically learned during instruction, it is a transfer test.

Defense System. Any weapon system, support system, or end item that supports a specific military mission, therefore requiring operations, maintenance, or support personnel training.

Discrimination. The process of making different responses to a stimulus. A discrimination requires a person to determine the differences among inputs and to respond differently to each.

Distance Learning. Training that is exported, such as from a resident course to a field location. Also called **Exportable Training**.

Duty. A large segment of the work done by an individual; major divisions of work in a job.

Evaluation. A judgment expressed as a measure or ranking of trainee achievement, instructor performance, process, application, training material, and other factors (see MIL-HDBK-29612). It includes **Formative Evaluation**; **Operational Evaluation**; and **Summative Evaluation**.

Evaluation Plan. A method or outline of a set of procedures which will be used to gather data and information for the purpose of assessing a course of instruction or other training product.

Exportable Training. See **Distance Learning**.

External Evaluation. The acquisition and analysis of feedback data from outside the formal training environment to evaluate the graduate of the instructional system in an operational environment. Also called **Field Evaluation**. Also see **Operational Evaluation**.

Feedback. Information that results from or is contingent upon an action. The feedback does not necessarily indicate the rightness of an action; rather, it relates the results of the action from which inferences about correctness can be drawn. Feedback may be immediate, as when a fuse blows because a lamp is incorrectly wired; or delayed, as when an instructor provides a discussion pertaining to an exam taken the previous week, or when completed graduate evaluation questionnaires are reviewed.

Fidelity. The degree to which a task or a training device represents the actual system performance, characteristics, and environment.

Field Evaluation. See **External Evaluation**.

Formative Evaluation. An activity that provides information about the effectiveness of training materials to meet training objectives and the trainees' acceptance of training materials as they are being developed. It is conducted while the instructional system or course is still under development, to gather data on lessons, units, or modules of instruction as they are completed. The purpose is make improvements to the system or course while development is still in progress. Also see **Evaluation**.

Generalization. Learning to respond to a new stimulus that is similar, but not identical, to one that was present during original learning. For example, during learning a child calls a beagle and spaniel by the term "dog"; a child who has generalized would respond "dog" when presented with a hound.

Instructional Media. The means used to present information to the trainee.

Instructional Objective. See **Objective**.

Instructional System. An integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques, and procedures performing effectively and efficiently the functions required to achieve specified learning objectives.

Instructional System Developer. A person who is knowledgeable of the instructional system development (ISD) process and is involved in the analysis, design, development, implementation and evaluation of instructional systems. Also called Instructional Designer, Instructional Developer, Curriculum Developer, Curriculum Development Manager, and other terms.

Instructional System Development (ISD). A deliberate and orderly, but flexible, process for planning, developing, implementing, and managing instructional systems. ISD ensures that personnel are taught in a cost-efficient way the skills, knowledge, and attitudes essential for successful job performance.

Interactive Courseware (ICW). Computer-controlled training designed to allow the student to interact with the learning environment through input devices such as keyboards and light pens. The student's decisions and inputs to the computer determine the level, order, and pace of instructional delivery, and forms of visual and aural outputs.

Interactive Video. Video that uses analog and digital databases to present instructional material in the ICW environment.

Interactive Videodisc (IVD). A form of ICW instruction that specifically makes use of videodisc technology. Video and audio signals are pressed onto the laser videodisc; programming codes may or may not be pressed onto the disc depending on the IVD level. As a result, motion sequence, still-frame shots, computer-generated graphics, and/or audio may be displayed and heard through a monitor under computer and user control.

Internal Evaluation. The acquisition and analysis of feedback and management data from within the formal training environment to assess the effectiveness of the instructional system. Also see **Operational Evaluation**.

Job. The duties, tasks, and task elements performed by an individual. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.

Job Aid. A checklist, procedural guide, decision table, worksheet, algorithm, or other device used by a job incumbent to aid in task performance. Job aids reduce the amount of information that personnel must recall or retain.

Job Analysis. The basic method used to obtain salient facts about a job, involving observation of workers, conversations with those who know the job, analysis questionnaires completed by job incumbents, or study of documents involved in performance of the job.

Job Performance Requirements (JPR). The tasks required of the human component of the system, the conditions under which these tasks must be performed, and the quality standards for acceptable performance. JPRs describe what people must do to perform their jobs.

Knowledge. Use of the mental processes that enable a person to recall facts, identify concepts, apply rules or principles, solve problems, and think creatively. Knowledge is not directly observable. A person manifests knowledge through performing associated overt activities. Also see **Attitude** and **Skill**.

Learning. A change in the behavior of the learner as a result of experience. The behavior can be physical and overt, or it can be intellectual or attitudinal.

Lesson Plan. An approved plan for instruction that provides specific definition and direction to the instructor on learning objectives, equipment, instructional media material requirements, and conduct of training. Lesson plans are the principal component of curriculum materials in that they sequence the presentation of learning experiences and program the use of supporting instructional material.

Media. The delivery vehicle for presenting instructional material or basic communication stimuli to a student to induce learning. Examples are instructors, textbooks, slides, and interactive courseware (ICW).

Media Selection. The process of selecting the most effective means of delivering instruction.

Metrics. Measurement tools used for assessing the qualitative and quantitative progress of instructional development with respect to the development standards specified.

Mockup. A three-dimensional training aid designed to represent operational equipment. It may be a scaled or cutaway model and may be capable of disassembly or operational simulation.

Motor Skill. Physical actions required to perform a specific task. All skills require some type of action.

Multimedia. The use of more than one medium to convey the content of instruction. Media available for use may include, but need not be limited to: text, programmed instruction, audio and video tapes/discs, slides, film, television, and computers.

Norm-Referenced Test. The process of determining a student's achievement in relation to other students. Grading "on the curve" involves norm-referenced measurement, since an individual's position on the curve (grade) depends on the performance of other students. Generally, norm-referenced measurement is not appropriate in the Air Force ISD process.

Objective. A statement that specifies precisely what behavior is to be exhibited, the conditions under which behavior will be accomplished, and the minimum standard of performance. Objectives describe only the behaviors that directly lead to or specifically satisfy a job performance requirement. An objective is a statement of instructional intent.

Operational Evaluation. The process of internal and external review of system elements, system requirements, instructional methods, courseware, tests, and process guide revision as needed to enhance the continued training effectiveness and efficiency of the training system during full-scale operations. The process begins at the training system readiness review and continues throughout the life of the training system. It includes **Internal Evaluation** and **External Evaluation**. Also see **Evaluation**.

Part-task Trainer (PTT). Operator trainers that allow selected aspects of a task (fuel system operation, hydraulic system operation, radar operation, etc.) to be practiced and a high degree of skill to be developed independently of other elements of the task.

Perceptual Skill. The process of information extraction; the process by which an individual receives or extracts information from the environment through experiences and assimilates this data as facts (sight, sound, feel, taste, smell).

Performance. Part of a criterion objective that describes the observable student behavior (or the product of that behavior) that is acceptable to the instructor as proof that learning has occurred.

Plan of Instruction (POI). A qualitative course control document designed for use primarily within a school for course planning, organization, and operation. Generally, criterion objectives, duration of instruction, support materials, and guidance factors are listed for every block of instruction within a course. Also called **Syllabus**.

Post-test. A criterion-referenced test designed to measure performance on objectives taught during a unit of instruction; given after the training.

Pretest. A criterion-referenced test designed to measure performance on objectives to be taught during a unit of instruction and performance on entry behavior; given before instruction begins.

Quality Air Force (QAF). A management philosophy and a methodology that work together to produce continuous process improvements. QAF implements Total Quality Management (TQM) in the Air Force.

Quality Improvement (QI). The organized creation of beneficial change; improvements made in products, procedures, learning, etc.

Ready for Training (RFT). The date on which sufficient equipment, training capabilities, personnel, and logistics elements are available to support full operational training.

Reliability. (a) A characteristic of evaluation which requires that testing instruments yield consistent results. (b) The degree to which a test instrument can be expected to yield the same result upon repeated administration to the same population. (c) The capability of a device, equipment, or system to operate effectively for a period of time without a failure or breakdown.

Simulator. (a) Hardware and software designed or modified exclusively for training purposes involving simulation or stimulation in its construction or operation to demonstrate or illustrate a concept or simulate an operational circumstance or environment. Training simulators and devices are considered part of the overall training system that may or may not be identified as part of the parent defense system. (b) Training equipment that imitates operational equipment both physically and functionally, such as a cockpit procedures trainer, operational flight trainer, or weapon systems trainer. Also see **Training Device**.

Simulator Certification (SIMCERT). The process of ensuring through validation of hardware and software baselines that a training system and its components provide the capability to train personnel to do specific tasks. The process ensures that the device continues to perform to the delivered specifications, performance criteria, and configuration levels. It will also set up an audit trail regarding specification and baseline data for compliance and subsequent contract solicitation or device modification.

Skill. The ability to perform a job-related activity that contributes to the effective performance of a task. Skills involve physical or manipulative activities that often require knowledge for their execution. All skills are actions having specific requirements for speed, accuracy, or coordination. Also see **Attitude** and **Knowledge**.

Subject Matter Expert (SME). (a) An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult, review, analyze, advise, or critique). (b) A person who has high-level knowledge and skill in the performance of a job.

Summative Evaluation. The overall assessment of a program at the completion of the developmental process. It is designed and used after the instructional system has become operational. Data gathered during this form of evaluation is used to determine the effectiveness of the instructional system. It identifies how well the system is working—that is, how well graduates can meet job performance requirements. Also see **Evaluation**.

Syllabus. See **Plan of Instruction**.

System Approach to Training (SAT). Procedures used by instructional system developers to develop instruction. Each phase requires input from the prior phase and provides input to the next phase. Evaluation provides feedback that is used to revise instruction. Also see **Instructional System Development**.

System Training Plan (STP). The specific document that includes program information and data concerning the system or equipment program, event, or situation that originated the training requirement, and describes the training required and the training programs to satisfy the requirement. The STP is designed to provide for planning and implementation of training and ensure that all resources and supporting actions required for establishment and support are considered.

Target Audience. The total collection of possible users of a given instructional system; the persons for whom the instructional system is designed.

Task. A unit of work activity or operation which forms a significant part of a duty. A task usually has clear beginning and ending points and directly observable or otherwise measurable processes, frequently but not always resulting in a product that can be evaluated for quantity, quality, accuracy, or fitness in the work environment. A task is performed for its own sake; that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a duty or job array.

Task Analysis. The process of describing job tasks in terms of Job Performance Requirements (JPR) and the process of analyzing these JPRs to determine training requirements. Also see **Job Performance Requirements**.

Task Decay Rate. A measure of how much delay can be tolerated between the time a task has been taught and the actual performance begins.

Terminal Objective. An objective the learner is expected to accomplish upon completion of the instruction. It is made up of enabling (support or subordinate) objectives.

Total Contract Training (TCT). A training concept that includes contract support for a contractor- operated training system. It includes instructors, curriculum, courseware, facilities, trainers, aircraft, spares, support equipment, and other support elements of contractor logistics support. The purpose of a TCT is to produce a trained student.

Training. A set of events or activities presented in a structured or planned manner, through one or more media, for the attainment and retention of skills, knowledge, and attitudes required to meet job performance requirements.

Training Device. Hardware and software designed or modified exclusively for training purposes involving simulation or stimulation in its construction or operation to demonstrate or illustrate a concept or simulate an operational circumstance or environment. Also see **Simulator**.

Training Fidelity. The extent to which cue and response capabilities in training allow for the learning and practice of specific tasks so that what is learned will enhance performance of the tasks in the operational environment.

Training Needs Assessment (TNA). The study of performance and the environment that influences it in order to make recommendations and decisions on how to close the gap between the desired performance and the actual performance.

Training Planning Team (TPT). An action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle design, development, acquisition, support, modification, funding, and management of a specific defense training system.

Training Requirement. The skills and knowledge that are needed to satisfy the job performance requirements and that are not already in the students' incoming repertoire.

Training Strategy. An overall plan of activities to achieve an instructional goal.

Training System. A systematically developed curriculum including, but not necessarily limited to, courseware, classroom aids, training simulators and devices, operational equipment, embedded training capability, and personnel to operate, maintain, or employ a system. The training system includes all necessary elements of logistic support.

Training System Support Center (TSSC). A consolidated function which contains the personnel, equipment, facilities, tools, and data necessary to provide life cycle hardware and software support for a training system.

Tutorial. (a) An instructional program that presents new information to the trainee in an efficient manner and provides practice exercises based on that information. (b) A lesson design used to teach an entire concept. (c) Interactive instruction that asks questions based on the information presented, requests trainee responses, and

evaluates trainee responses. Tutorials are self-paced, accommodate a variety of users, and generally involve some questioning, branching, and options for review.

Validation. The process of developmental testing, field testing, and revision of the instruction to be certain the instructional intent is achieved. The instructional system is developed unit by unit and tested (or validated) on the basis of the objective prepared for each unit.

Validity. The degree to which a criterion test actually measures what it is intended to measure.

Videodisc. A medium of audiovisual information storage for playback on a television monitor.

Videotape. A magnetic tape that can record and play back audio (sound) and video (pictures).

Weapon System. A combination of one or more weapons with all related equipment, materials, services, personnel, training, and means of delivery and deployment (if applicable) required for self-sufficiency. For purposes of this handbook, a weapon system is that portion of the system that conducts the mission.

Weapon System Trainer (WST). A device which provides an artificial training/tactics environment in which operators learn, develop, improve and integrate mission skills associated with their crew position in a specific defense system.